PROJECT MANUAL FOR

AG TEC INNOVATION CENTER

FEDERAL AWARD (EDA) ID NUMBER: 07-79-07882

MERCED COMMUNITY COLLEGE DISTRICT
3600 M STREET
MERCED, CA 95348

PREPARED BY:

DARDEN ARCHITECTS, INC.
ARCHITECTURE•PLANNING•INTERIORS
6790 N. WEST AVENUE
FRESNO, CALIFORNIA 93711

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 02-122058 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 8/29/2024

LICENSED ARCHITECT
GRANT E. DODSON
No. C-20,307
Ren. 6-30-25
STATE OF CALIFORNIA

ARCHITECT

REGISTERED PROFESSIONAL ENGINEER
COLIN P. BLANEY
No. 4377
STRUCTURAL
STATE OF CALIFORNIA

STRUCTURAL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
JONATHAN C. SCHLUNDT
M35955
Exp. 06-30-26
MECHANICAL
STATE OF CALIFORNIA

MECHANICAL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
JEFFREY M. THOM
NO. 20823
ELECTRICAL
STATE OF CALIFORNIA

ELECTRICAL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
ZACHARY D. HOCKETT
No. 87,218
CIVIL
STATE OF CALIFORNIA

CIVIL ENGINEER

LICENSED LANDSCAPE ARCHITECT
DAVID W. BRILEY NO. 2835
Signature
12/31/24
Renewal Date
07/30/2024
Date
STATE OF CALIFORNIA

LANDSCAPE ARCHITECT

END OF SECTION

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NOTICE CALLING FOR BIDS

DISTRICT	MERCED COMMUNITY COLLEGE DISTRICT
PROJECT DESCRIPTION	**BID #2024-19 AG TECH PROJECT**
PROJECT BUDGET	$18,000,000.00
LATEST TIME/DATE FOR SUBMISSION OF BID PROPOSALS	2:00 P.M. Tuesday, February 25, 2025
LOCATION FOR SUBMISSION OF BID PROPOSALS	Merced College, Purchasing Office (Corner University Drive and West Community College Drive) 3600 M Street, Merced, California 95348
LOCATION FOR OBTAINING BID AND CONTRACT DOCUMENTS	https://www.fresnorepro.com/jobs/public

NOTICE IS HEREBY GIVEN that the Merced Community College District (District), acting by and through its Board of Trustees, will receive up to, but not later than the above-stated date and time, sealed Bid Proposals for the Contract for the Work generally described as:

BID #2024-19 AG TECH PROJECT

1. Submittal of Bid Proposals. All Bid Proposals must be submitted on forms furnished by the District prior to the last time for submission of Bid Proposals and the District's public opening and reading of Bid Proposals.
2. Bid and Contract Documents. All Bid and Contract Documents are available through Fresno Reprographics, through the link provided above.
3. Documents Accompanying Bid Proposal. Each Bid Proposal shall be accompanied by: (i) the required Bid Security; (ii) Subcontractors List; (iii) Statement of Qualifications; (iv) Non-Collusion Affidavit; and (v) DIR Registration Verification.
4. Project Budget. The Project Budget for the Work is set forth above. If bidding for the Work includes Alternate Bid Items, the selection of Alternate Bid Items for determination of the lowest priced Bid Proposal will be by priority of Alternate Bid Items, up to but not exceeding the Project Budget. If bidding for the Work does not include Alternate Bid Items, the Project Budget set forth above is for information purposes only.
5. Pre-Bid Inquiries. Bidders may submit pre-bid inquiries or clarification requests. Bidders are solely and exclusively responsible for submitting pre-bid inquiries or clarification requests no later than **2:00 PM SEVEN (7) Calendar days** before the latest date for submittal of Bid Proposals. Pre-bid inquiries or clarification requests shall be submitted to. PurchasingBids@mccd.edu
6. Prevailing Wage Rates. The Contractor and all Subcontractors shall pay not less than the applicable prevailing wage rate for the classification of labor provided by their respective workers to execute the Work. Copies of the prevailing wage rates in the locality where the Work is to be performed, entitled PREVAILING WAGE SCALE are available to any interested party on the INTERNET at http://www.dir.ca.gov/dlsr/statistics_research.html. In addition to compliance with prevailing wage

requirements, the successful Bidder shall comply with all other applicable provisions of the Labor Code, the California Code of Regulations and rulings or determinations of the California Department of Industrial Relations. During the Work and pursuant to Labor Code §1771.4(a)(4), the Department of Industrial Relations shall monitor compliance with prevailing wage rate requirements and enforce the Contractor's prevailing wage rate obligations. **The higher of California DIR and federal Davis Bacon Wage Rates required will prevail for any one trade.**

7. Contractors' License Classification. Bidders must possess the following classification(s) of California Contractors License at the time that the Bid Proposal is submitted and at time the Contract for the Work is awarded: **B - General Building.** The Bid Proposal of a Bidder who does not possess a valid and in good standing Contractors' License in the classification(s) set forth above will be rejected for non-responsiveness. Any Bidder not duly and properly licensed is subject to all penalties imposed by law. No payment shall be made for the Work unless and until the Registrar of Contractors verifies to the District that the Bidder awarded the Contract is properly and duly licensed for the Work.

8. Contract Time. Completion of the Work shall be achieved within the time set forth in Contract Documents after the date for commencement of the Work established in the Notice to Proceed issued by the District. Failure to achieve Completion within the Contract Time will result in the assessment of Liquidated Damages as set forth in the Contract.

9. Bid Security. Each Bid Proposal shall be accompanied by Bid Security in an amount equal to TEN PERCENT (10%) of the maximum amount of the Bid Proposal, inclusive of the value of any additive Alternate Bid Item(s). A Bid Proposal not accompanied by Bid Security in the form and in the amount required is non-responsive and will be rejected by the District.

10. Payment Bond; Performance Bond. Prior to commencement of the Work, the Bidder awarded the Contract shall deliver to the District a Payment Bond and a Performance Bond issued by a California Admitted Surety in the form and content included in the Contract Documents in a penal sum equal to One Hundred Percent (100%) of the Contract Price. The Payment Bond and the Performance Bond shall be issued by a California Admitted Surety in the form and content included in the Contract Documents.

11. No Withdrawal of Bid Proposals. Bid Proposals shall not be withdrawn by any Bidder for a period of sixty (60) **days** after the opening of Bid Proposals. During this time, all Bidders shall guarantee prices quoted in their respected Bid Proposals.

12. Return of Executed Agreement. The Bidder awarded the Contract shall execute the Agreement and return the executed Agreement to the District within three (3) **calendar days** from the date of receiving notification that it is the Bidder to whom the Contract has been awarded. If the successful Bidder fails to return the executed Agreement pursuant to the foregoing, the District may declare the Bidder's Bid Security forfeited as damages caused by the failure of the Bidder to enter into the Contract and may thereupon award the Contract for the Work to the responsible Bidder submitting the next lowest Bid Proposal or may call for new bids, in its sole and exclusive discretion.

13. Job-Walk. The District will conduct **Mandatory Job Walks** on **Thursday, January 16, 2025, & Thursday January 23, 2025,** beginning at **10:00 AM. Contractors are required to attend a minimum of one mandatory job walk**. Contractors are to meet at Merced College Purchasing Department, for conduct of the Job Walk. The Bid Proposal submitted by a Bidder whose representative(s) did not attend the entirety of the Mandatory Job Walk will be rejected by the District as being non-responsive. Access to the Job Walk will be available to Bidders for ten (10) minutes after the scheduled start time of the Job Walk; no access to the Job Walk will be permitted thereafter. A Bidder whose representative(s) arrive at the Job Walk location more than ten (10) minutes after the scheduled start of the Job Walk will be denied access and will not be deemed to have attended the Job Walk.

DISTRICT MAP HYPERLINK

14. Waiver of Irregularities. The District reserves the right to reject any or all Bid Proposals or to waive any irregularities or informalities in any Bid Proposal or in the bidding.

15. Award of Contract. The Contract for the Work, if awarded, will be by action of the District's Board of Trustees to the responsible Bidder submitting the lowest priced responsive Bid Proposal. If the Bid Proposal requires Bidders to propose prices for Alternate Bid Items, the District's selection of Alternate Bid Items, if any, for determination of the lowest priced Bid Proposal and for inclusion in the scope of the Contract to be awarded shall be in accordance with the Instructions for Bidders.

Merced Community College District

Advertisement Publications: January 9, 2025 & January 16, 2025

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INSTRUCTIONS FOR BIDDERS

1. Preparation and Submittal of Bid Proposal.

1.1. Bid Proposal Preparation. All information required by the bid forms must be completely and accurately provided. Numbers shall be stated in both words and figures where required in the bid forms; conflicts between a number stated in words and in figures are governed by the words. Partially completed Bid Proposals or Bid Proposals submitted on other than the bid forms included herein are non-responsive and will be rejected. Bid Proposals not conforming to these Instructions for Bidders and the Notice to Contractors Calling for Bids ("Call for Bids") may be deemed non-responsive and rejected.

1.2. Bid Proposal Submittal. Bid Proposals shall be submitted at the place designated in the Call for Bids in sealed envelopes bearing on the outside the Bidder's name and address along with an identification of the Work for which the Bid Proposal is submitted. Bidders are solely responsible for timely submission of Bid Proposals to the District at the place designated in the Call for Bids.

1.3. Date and Time of Bid Proposal Submittal. A Bid Proposal is submitted only if the outer envelope containing the Bid Proposal is marked with the Project title and is received by a District Purchasing Department representative for logging-in at (or before) the latest date and time for submittal of Bid Proposals. The official U.S. time-clock website: https://www.time.gov/ is controlling and determinative as to the time of the Bidder's submittal of the Bid Proposal. The foregoing notwithstanding, whether or not Bid Proposals are opened exactly at the time fixed in the Call for Bids, no Bid Proposals shall be received or considered by the District after it has commenced the public opening and reading of Bid Proposals; Bid Proposals submitted after such time are non-responsive and will be returned to the Bidder unopened.

2. Bid Security. Each Bid Proposal shall be accompanied by Bid Security in the form of: (i) cash, (ii) a certified or cashier's check made payable to the District or (iii) a Bid Bond, in the form and included with the Contract Documents (the "Bid Security") in at least the amount set forth in the Call for Bids. A Bid Proposal submitted without the required Bid Security is non-responsive and will be rejected. If the Bid Security is in the form of a Bid Bond, the Bidder's Bid Proposal is deemed responsive only if the Bid Bond is in the form and content included herein and the Surety is an Admitted Surety Insurer under Code of Civil Procedure §995.120.

3. Documents Accompanying Bid Proposal; Signatures. The Bid Proposal and all other documents required to be submitted with the Bid Proposal shall be executed by an individual duly authorized to execute the same on behalf of the Bidder; failure of a Bid Proposal to conform to the foregoing will render the Bid Proposal non-responsive and rejected.

4. Bidder and Subcontractors' DIR Registered Contractor Status. Each Bidder must be a DIR Registered Contractor when submitting a Bid Proposal. The Bid Proposal of a Bidder who is not a DIR Registered Contractor when the Bid Proposal is submitted will be rejected for non-responsiveness. All Subcontractors identified in a Bidder's Subcontractors' List must be DIR Registered contractors at the time the Bid Proposal is submitted. The foregoing notwithstanding, a Bid Proposal is not subject to rejection for non-responsiveness for listing Subcontractor the Subcontractors List who is/are not DIR Registered contractor(s) if such Subcontractor(s) complete DIR Registration pursuant to Labor Code §1771.1(c)(1) or (2). Further, a Bid Proposal is not subject to rejection if the Bidder submitting the Bid Proposal lists any Subcontractor(s) who is/are not DIR Registered contractors and such Subcontractor(s) do not become DIR Registered pursuant to Labor Code §1771.1(c)(1) or (2) prior to award of the Contract, the Bidder, if awarded the Contract, must request consent of the District to substitute a DIR Registered Subcontractor for any non-DIR Registered Subcontractor(s) pursuant to Labor Code §1771.1(c)(3) without adjustment of the Contract Price or the Contract Time.

5. Modifications or Withdrawal of Bid Proposal. Changes to the bid forms which are not specifically called for or permitted may result in the District's rejection of the Bid Proposal as being non-

responsive. No oral or telephonic modification of any submitted Bid Proposal will be considered. After submittal of a Bid Proposal, a Bidder may modify or withdraw its Bid Proposal only by written request actually received by the District prior to the scheduled closing time for the receipt of Bid Proposals and the District's public opening and reading of Bid Proposals; written requests to withdraw or modify a submitted Bid Proposal received by the District after the scheduled closing time for receipt of Bid Proposals shall not be considered by the District, nor effective to withdraw such Bid Proposal.

6. Erasures; Inconsistent or Illegible Bid Proposals. Erasures, interlineations or other corrections to any document submitted with a Bid Proposal shall be suitably authenticated by affixing in the margin immediately opposite such erasure, interlineations or correction the surname(s) of the person(s) signing the Bid Proposal. Any Bid Proposal not conforming to the foregoing may be deemed by the District to be non-responsive. If any Bid Proposal or portions thereof, is determined by the District to be illegible, ambiguous or inconsistent, the District may reject such a Bid Proposal as being non-responsive.

7. Examination of Site and Contract Documents. Each Bidder shall, at its sole cost and expense, inspect the Site and to become fully acquainted with the Contract Documents and conditions affecting the Work. Failure of a Bidder to receive or examine any of the Contract Documents or to inspect the Site shall not relieve such Bidder from any obligation with respect to the Bid Proposal, or the Work required under the Contract Documents. The District assumes no responsibility or liability to any Bidder for, nor shall the District be bound by, any understandings, representations or agreements of the District's agents, employees or officers concerning the Contract Documents or the Work made prior to execution of the Contract which are not in the form of Bid Addenda duly issued by the District. The submission of a Bid Proposal shall be deemed prima facie evidence of the Bidder's full compliance with the requirements of this section.

8. Agreement and Bonds. The Agreement which the successful Bidder, as Contractor, will be required to execute along with the forms Payment Bond, Performance Bond and other documents and instruments which are required to be furnished are included in the Contract Documents and shall be carefully examined by the Bidder.

9. Interpretation of Drawings, Specifications or Contract Documents. The District will respond to any pre-bid inquiry submitted in accordance with requirements established in the Call for Bids. If in the sole discretion of the District, a response to a pre-bid inquiry affects or potentially affects other Bidders, the Work, the Contract Documents or other requirements, the District will issue addenda. A copy of any such addendum will be delivered by fax, email or mail to each Bidder receiving a set of the Contract Documents. No person is authorized to render an oral interpretation or correction of any portion of the Contract Documents to any Bidder, and no Bidder is authorized to rely on any such oral interpretation or correction. Failure to request interpretation or clarification of any portion of the Contract Documents pursuant to the foregoing is a waiver of any discrepancy, defect or conflict therein.

10. District's Right to Modify Contract Documents. Before the public opening and reading of Bid Proposals, the District may modify the Work, the Contract Documents, or any portion(s) thereof by the issuance of written addenda disseminated to all Bidders who have obtained a copy of the Specifications, Drawings and Contract Documents pursuant to the Call for Bids. If the District issues any addenda during the bidding, the failure of any Bidder to acknowledge such addenda in its Bid Proposal will render the Bid Proposal non-responsive and rejected.

11. Bidders Interested in More Than One Bid Proposal; Non-Collusion Affidavit. No person, firm, corporation or other entity shall submit or be interested in more than one Bid Proposal for the same Work; provided, however, that a person, firm or corporation that has submitted a sub-proposal to a Bidder or who has quoted prices for materials to a Bidder is not disqualified from submitting a sub-proposal, quoting prices to other Bidders or submitting a Bid Proposal for the proposed Work to the

District. The form of Non-Collusion Affidavit included in the Contract Documents must be completed and duly executed on behalf of the Bidder; failure of a Bidder to submit a completed and executed Non-Collusion Affidavit with its Bid Proposal will render the Bid Proposal non-responsive.

12. Award of Contract.

12.1. Waiver of Irregularities or Informalities. The District reserves the right to reject any and all Bid Proposals or to waive any irregularities or informalities in any Bid Proposal or in the bidding.

12.2. Award to Lowest Responsive Responsible Bidder. The award of the Contract, if made by the District through action of its Board of Trustees, will be to the responsible Bidder submitting the lowest responsive Bid Proposal on the basis of the Base Bid Proposal and Alternate Bid Items selected in accordance with these Instructions.

12.3. Selection of Alternate Bid Items. Additive Alternate Bid Items ("ALT"), if any, will be accepted by the District in the order of priority established by the District, with the highest prioritized ALT being ALT 1. The Contract for the Work will be awarded to the Bidder submitting the lowest priced responsive Bid Proposal for the Base Bid scope and the maximum number of ALTs up to but not exceeding the Project Budget set forth in the Call for Bids. In the following example, Bidder B proposes $19,000 for the Base Bid plus ALTS 1-3, Bidder A proposes $20,000 and Bidder C proposes for the Base Bid plus ALTS 1-3. Pricing for the Base Bid and ALT 4 to any Bidder exceeds the Project Budget. Hence: Bidder B submitted the lowest priced proposal for the Base Bid and the maximum number of ALTs within the Project Budget.

Project Budget: $19,000 (EXAMPLE)							
BID PRICING					**BASE BID + ALTS**		
	BIDDER A	BIDDER B	BIDDER C		BIDDER A	BIDDER B	BIDDER C
Base Bid	$5,000	$5,500	$4,800		$5,000	$5,500	$4,800
ALT 1	$8,000	$7,500	$7,800		$13,000	$13,000	$12,600
ALT 2	$1,000	$1,000	$1,200		$14,000	$14,000	$13,800
ALT 3	$6,000	$5,000	$7,000		$20,000	$19,000	$20,800
ALT 4	$150	$120	$200		$20,150	$19,150	$21,000

12.4. Alternate Bid Items Not Included in Award of Contract. Bidders are referred to the provisions of the Contract Documents permitting the District, during performance of the Work, to add or delete from the scope of the Work any or all of the Alternate Bid Items with the cost or credit of the same being the amount(s) set forth by in the Alternate Bid Items Bid on the Proposal.

12.5. Responsive Bid Proposal. A responsive Bid Proposal shall mean a Bid Proposal which conforms, in all material respects, to requirements of the Bid and Contract Documents.

12.6. Responsible Bidder. Determination of the responsibility of Bidders is based on the following evaluation criteria.

12.6.1. Bidder Capacity. Factors affecting the Bidder's capacity to perform and complete the Work will be assessed, including: (i) Bidder's access to labor, materials and other resources necessary to complete the Work; (ii) Bidder's ability to complete the Work within the time established for completion of the Work, or portions thereof; and (iii) Bidder's ability to complete warranty obligations.

12.6.2. Bidder Character, Integrity. Factors reflecting the character and integrity of the Bidder, including: (i) other public agency finding/determination, within the past five (5) years, that

the Bidder is not responsible; (ii) currently debarred from bidding public works projects or debarment from bidding within past five (5) years; and (iii) false claims liability within the past five (5) years under local, state or federal laws.

12.6.3. Bidder Financial Capability. Factors considered include: (i) sufficiency of the Bidder's financial resources; (ii) whether the Bidder is current in payment of debts and performance of other financial obligations; and (iii) bankruptcy or insolvency proceedings have been instituted within the past five (5) years.

12.6.4. Bidder Prior Performance. The Bidder's prior performance on prior public works contracts, including without limitation: (i) cost overruns; (ii) compliance with general conditions and other contractual requirements, including schedule development, schedule updates and coordination of labor, material/equipment procurements and subcontractors; (iii) completion within allocated time; (iv) submittal of unsubstantiated, unsupported or excessive cost proposals, claims or contract adjustment requests; (iv) completion of a project by a surety; (vi) owner's exercise of default remedies; and (vii) finding or determination by any public agency that the Bidder is not a responsible bidder.

12.6.5. Safety. Factors include: (i) findings of serious or willful safety violations of safety laws, regulations or requirements by any local, state or federal agency within the past five (5) years; (ii) adequacy and implementation of safety plans, programs for on-site and off-site construction and construction related activities; and (iii) Workers Compensation Insurance EMR rating exceeding 1.25.

13. Subcontractors.

13.1. Designation of Subcontractors; Subcontractors List. Each Bidder shall submit a list of its proposed Subcontractors for the proposed Work as required by the Subletting and Subcontracting Fair Practices Act (California Public Contract Code §§ 4100 et seq.) on the form furnished. The failure of any Bid Proposal to include all information required by the Subcontractors List will result in rejection of the Bid Proposal for non-responsiveness.

13.2. Work of Subcontractors. All Bidders are referred to the Contract Documents and the notation therein that all Contract Documents are intended to be complimentary and that the organization or arrangements of the Specifications and Drawings shall not limit the extent of the Work of the Contract Documents. Accordingly, all Bidders are encouraged to disseminate all of the Specifications, Drawings and other Contract Documents to all persons or entities submitting sub-bids to the Bidder. The omission of any portion or item of Work from the Bid Proposal or from the sub-bidders' sub-bids which is/are necessary to produce the intended results and/or which are reasonably inerrable from the Contract Documents is not a basis for adjustment of the Contract Price or the Contract Time.

13.3 Subcontractor Bonds. In accordance with California Public Contract Code §4108, if a Bidder requires a bond or bonds of its Subcontractor(s), whether the expense of procuring such bond or bonds are to be borne by the Bidder or the Subcontractor(s), such requirements shall be specified in the Bidder's written or published request for sub-bids. Failure of the Bidder to comply with these requirements shall preclude the Bidder from imposing bonding requirements upon its Subcontractor(s) or rejection of a Subcontractor's bid under California Public Contract Code §4108(b).

14. Workers' Compensation Insurance. Pursuant to California Labor Code § 3700, the successful Bidder shall secure Workers' Compensation Insurance for its employees engaged in the Work of the Contract. The successful Bidder shall execute and deliver to the District the form of Workers Compensation Certification included in the Contract Documents concurrently with such Bidder's delivery of the executed Agreement to the District.

15. Bid Security Return. The Bid Security of the Bidders submitting the three lowest priced Bid Proposals, the number being solely at the discretion of the District, will be held by the District for ten (10) days after the period for which Bid Proposals must be held open (which is set forth in the Call for Bids) or until posting by the successful Bidder(s) of the bonds, certificates of insurance required and return of executed copies of the Agreement, whichever first occurs, at which time the Bid Security of such other Bidders will be returned to them.

16. Contractor's License. No Bid Proposal will be considered from a Bidder who, at the time Bid Proposals are opened, is not licensed to perform the Work of the Contract Documents, in accordance with the Contractors' License Law, California Business & Professions Code §§7000 et seq. This requirement is not a mere formality and will not be waived by the District or its Board of Trustees. The required California Contractors' License classification(s) for the Work is set forth in the Call for Bids.

17. Non-Discriminatory Practices. It is the policy of the District that there be no discrimination against any prospective or active employee engaged in the Work because of race, color, ancestry, national origin, religious creed, sex, age, marital status or other legally protected classification. All Bidders agree to comply with the District's non-discrimination policy and all applicable Federal and California anti-discrimination laws including but not limited to the California Fair Employment & Housing Act beginning with California Government Code §§ 12940 et seq. and California Labor Code § 1735. In addition, all Bidders agree to require like compliance by any Subcontractor employed by them on the Work of the Contract.

18. Bidder's Qualifications. Each Bidder shall submit with its Bid Proposal the form of Statement of Bidder's Qualifications, which is included within the Contract Documents. All information required by Statement of Bidder's Qualifications shall be completely and fully provided. Any Bid Proposal not accompanied by the Statement of Bidder's Qualifications completed with all information required and bearing the signature of the Bidder's duly authorized representative under penalty of perjury will render the Bid Proposal non-responsive and rejected. If the District determines that any information provided by a Bidder in the Statement of Bidder's Qualifications is false or misleading, or is incomplete so as to be false or misleading, the District may reject the Bid Proposal submitted by such Bidder as being non-responsive.

19. Job-Walk. The District will conduct a Job-Walk at the time(s) and place(s) designated in the Call for Bids. The District may, in its sole and exclusive discretion, elect to conduct one or more Job-Walk(s) in addition to that set forth in the Call for Bids, in which event the District shall notify all Bidders who have theretofore obtained the Contract Documents pursuant to the Call for Bids of any such additional Job-Walk. If the District elects to conduct any Job-Walk in addition to that set forth in the Call for Bids, the District shall, in its notice of any such additional Job-Walk(s), indicate whether Bidders' attendance at such additional Job-Walk(s) is/are mandatory. If attendance at the Job Walk is indicated in the Call for Bids as being mandatory, the failure of any Bidder to have its authorized representative present at the entirety of the Job-Walk will render the Bid Proposal of such Bidder to be non-responsive. Where the Job-Walk is mandatory, a Bidder may have more than one authorized representative and/or representatives of its Subcontractors present at the Job-Walk; provided, however that attendance by representatives of the Bidder's Subcontractors without attendance by a representative of the Bidder shall not be sufficient to meet the Bidder's obligations hereunder and will render the Bid Proposal of such Bidder to be non-responsive. The District will reject the Bid Proposal of a Bidder who obtains the Bid and Contract Documents after the date of the Mandatory Job-Walks set forth in the Call for Bids unless a Job-Walk is requested by such Bidder and a Job-Walk is conducted by the District in accordance with the following provisions. The District may, in its sole and exclusive discretion, conduct such requested Job-Walk taking into consideration factors such as the time remaining prior to the scheduled opening of Bid Proposals. Any such requested Job Walk will be conducted only upon the requesting Bidder's agreement to reimburse the District

for the actual and/or reasonable costs for the District's staff and its agents and representatives in arranging for and conducting such additional Job-Walk.

20. Public Records. Bid Proposals and other documents responding to the Call for Bids become the exclusive property of the District upon submittal to the District. At such time as the District issues the Notice of Intent to award the Contract pursuant to these Instructions for Bidders, all Bid Proposals and other documents submitted in response to the Call for Bids become a matter of public record and shall be thereupon be considered public records, except for information contained in such Bid Proposals deemed to be Trade Secrets (as defined in California Civil Code § 3426.1) and information provided in response to the Statement of Qualifications. A Bidder that indiscriminately marks all or most of its Bid Proposal as exempt from disclosure as a public record, whether by the notations of "Trade Secret," "Confidential," "Proprietary," or other similar notations, may result in, or render, the Bid Proposal non-responsive and rejected. The District is not liable or responsible for the disclosure of such records, including those exempt from disclosure if disclosure is deemed required by law, by an order of Court, or which occurs through inadvertence, mistake or negligence on the part of the District or its officers, employees or agents. At such time as Bid Proposals are deemed a matter of public record, pursuant to the above, any Bidder or other party shall be afforded access for inspection and/or copying of such Bid Proposals, by request made to the District in conformity with the California Access to Public Records Act, California Government Code §§6250, et. seq. If the District is required to defend or otherwise respond to any action or proceeding wherein request is made for the disclosure of the contents of any portion of a Bid Proposal deemed exempt from disclosure hereunder, the Bidder submitting the materials sought by such action or proceeding agrees to defend, indemnify and hold harmless the District in any action or proceeding from and against any liability, including without limitation attorneys' fees arising therefrom. The party submitting materials sought by any other party shall be solely responsible for the cost and defense in any action or proceeding seeking to compel disclosure of such materials; the District's sole involvement in any such action shall be that of a stakeholder, retaining the requested materials until otherwise ordered by a court of competent jurisdiction.

21. Drug Free Workplace Certificate. In accordance with California Government Code §§ 8350 et seq., the Drug Free Workplace Act of 1990, the successful Bidder will be required to execute a Drug Free Workplace Certificate concurrently with execution of the Agreement. The successful Bidder will be required to implement and take the affirmative measures outlined in the Drug Free Workplace Certificate and in California Government Code §§8350 et seq. Failure of the successful Bidder to comply with the measures outlined in the Drug Free Workplace Certificate and in California Government Code §§ 8350 et seq. may result in penalties, including without limitation, the termination of the Agreement, the suspension of any payment of the Contract Price otherwise due under the Contract Documents and/or debarment of the successful Bidder.

22. Notice of Intent to Award Contract. Following the public opening and reading of Bid Proposals, the District will issue a Notice of Intent to Award the Contract, identifying the Bidder to whom the District intends to award the Contract and the date/time/place of the District's Board of Trustees meeting at which award of the Contract will be considered.

23. Bid Protest.

    23.1. Submittal of Bid Protest. Any Bidder submitting a Bid Proposal to the District may file a protest of the District's intent to award the Contract provided that all of the following are complied with: (i) the bid protest is in writing; (ii) the bid protest is filed and received by the District's Vice-President, Administrative Services not more than five (5) calendar days following the date of issuance of the District's Notice of Intent to Award the Contract; and (iii) the written bid protest sets forth, in detail, all grounds for the bid protest, including without limitation all facts, supporting documentation, legal authorities and argument in support of the grounds for the bid protest; any matters not set forth in the written bid protest shall be deemed waived. All factual

contentions must be supported by competent, admissible and creditable evidence. Any bid protest not conforming to the foregoing shall be rejected by the District as invalid.

23.2. District Review and Disposition of Bid Protest. Provided that a bid protest is filed in strict conformity with the foregoing, the District's Vice-President, Administrative Services or such individual(s) as may be designated by him/her (Designee), shall review and evaluate the basis of the bid protest. The District's Vice-President, Administrative Services or Designee shall provide the Bidder submitting the bid protest with a written statement concurring with or denying the bid protest (Bid Protest Response). The Bid Protest Response is deemed the final action of the District and not subject to appeal or reconsideration by any other employee or officer of the District or the Board of Trustees of the District. The issuance of the Bid Protest Response by the District's Vice-President, Administrative Services or the Designee is an express condition precedent to the institution of any legal or equitable proceedings relative to the bidding process, the District's intent to award the Contract, the District's disposition of any bid protest or the District's decision to reject all Bid Proposals. If any such legal or equitable proceedings are instituted and the District is named as a party thereto, the prevailing party(ies) shall recover from the other party(ies), as costs, all attorneys' fees and costs incurred in connection with any such proceeding, including any appeal arising therefrom.

24. Federal Participation Disclosure. This project will be partially funded with Federal funds from the United States Department of Commerce, Economic Development Administration and therefore is subject to the Federal laws and regulations associated with that program.

[END OF SECTION]

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BID PROPOSAL

Project: BID #2024-19 AG TECH PROJECT

Bidder Name	_____	
Bidder Representative(s)	_____ Name and Title _____ Name and Title	
Bidder Representative(s) Contact Information	Email Address(es) _____ _____	Phone/Fax (_____) _____ Telephone (_____) _____ Fax
Bidder Mailing Address	_____ Address _____ City/State/Zip Code	
California Contractors' License	_____ Number _____ Classification(s) and Expiration Date	

1. **Bid Proposal**.

1.1 Bid Proposal Amount. The undersigned Bidder proposes and agrees to perform the Contract including, without limitation, providing and furnishing any and all of the labor, materials, tools, equipment and services necessary to perform all obligations under the Contract Documents and to complete the Work required for the sum of _____Dollars ($_____).

1.2 Vapor Alkalinity Control:

Itemize here, for possible deductive Change Order during the course of the project if determined to not be needed, the amount required for Specification Section – VAPOR ALKALINITY CONTROL. This amount shall also be included with the lump sum Bid Proposal Amount stated above.

_____Dollars ($_____).

1.3 Acknowledgment of Bid Addenda. The Bidder confirms that this Bid Proposal incorporates and is inclusive of, all items or other matters contained in Bid Addenda issued by or on behalf of the District.

_____ **Addenda Nos.** _____ received, acknowledged
(initial) and incorporated into this Bid Proposal.

1.4 Alternate Bid Items. The Bidder's proposed pricing for each Alternate Bid Item, if any, are set forth in the accompanying form of Alternate Bid Items Proposal. Failure of a Bidder to propose pricing for each Alternate Bid Item set forth in the accompanying Alternate Bid Items Proposal will result in the Bid Proposal being deemed non-responsive and rejected.

2. Documents Accompanying Bid Proposal. The Bidder has submitted with this Bid Proposal the following: (i) Bid Security; (ii) Subcontractors List; (iii) Statement of Qualifications; (iv) Non-Collusion Affidavit; and (v) DIR Registration Verification. The Bidder acknowledges that if this Bid Proposal and the foregoing documents are not fully in compliance with applicable requirements set forth in the Call for Bids, the Instructions for Bidders and in each of the foregoing documents, the Bid Proposal may be rejected as non-responsive.

3. Award of Contract. Concurrently with delivery of the executed Agreement to the District, the Bidder awarded the Contract shall deliver to the District: (i) Certificates of Insurance evidencing all insurance coverages required under the Contract Documents; (ii) Performance Bond; (iii) Labor and Material Payment Bond; (ii) Certificate of Workers' Compensation Insurance; and (iv) Drug-Free Workplace Certificate. Failure of the Bidder awarded the Contract to strictly comply with the preceding may result in the District's rescinding award of the Contract and/or forfeiture of the Bidder's Bid Security.

4. Bidder Certifications. The Bidder certifies the following to the District:
   4.1 Contractor License. The Bidder certifies that: (i) it is possesses a valid and in good standing Contractors' License, in the necessary class(es), for performing the Work as set for in the Call for Bids; (ii) that such license shall be in full force and effect throughout the duration of the performance of the Work; and (ii) that all Subcontractors providing or performing any portion of the Work are properly licensed to perform their respective portions of the Work at the time of submitting this Bid Proposal and at all times during their performance of the Work.

   4.2 DIR Registration. The Bidder certifies to the District that the Bidder is a DIR Registered contractor and that during the Work, the Bidder will verify that all subcontractors, of any tier performing any portion of the Work are DIR Registered contractors. All Work will be performed and completed by DIR Registered contractors.

5. Agreement to Bidding Requirements and Attorneys' Fees. The undersigned Bidder acknowledges and confirms its receipt, review and agreement with, the contractual requirements set forth in this Bid Proposal and the Contract Documents. By executing this Bid Proposal hereinbelow, the Bidder expressly acknowledges and agrees that if the Bidder institutes any legal or equitable proceedings in connection with this Bid Proposal and the District is named as a party thereto, the prevailing party(ies) shall recover from the other party(ies), as costs, all attorneys' fees and costs incurred in connection with any such proceeding, including any appeal arising therefrom. This provision shall constitute a binding attorneys' fee agreement in accordance with and pursuant to California Civil Code §1717 which shall be enforceable against the Bidder and the District. This attorneys fee provision shall be solely limited to legal or equitable proceedings arising out of a bid protest or the bidding process and shall not extend to or have any force and effect on the Contract for the Work or to modify the terms of the Contract Documents for the Work.

6. Acknowledgment and Confirmation. The undersigned Bidder acknowledges its receipt, review and understanding of the Drawings, the Specifications and other Contract Documents pertaining to the proposed Work. The undersigned Bidder certifies that the Contract Documents are, in its opinion, adequate, feasible and complete for providing, performing and constructing the Work in a sound and suitable manner for the use specified and intended by the Contract Documents. The undersigned Bidder certifies that it has, or has available, all necessary equipment, personnel, materials, facilities and technical and financial ability to complete the Work for the amount bid herein within the Contract Time and in accordance with the Contract Documents.

By: _____

(Signature of Bidder's Authorized Officer
or Representative)

_____

(Typed or Printed Name)

Title: _____

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SUBCONTRACTORS LIST

Project ("the Work")	**BID # 2024-19 AG TECH PROJECT**
Bidder Name	_____
Bidder's Representative Signature	_____ (Signature) _____ (Typed or Printed Name)

Licensed Name of Subcontractor	Trade or Portion of Work	Address of Office, Mill or Shop	Subcontractor CSLB License No.	DIR Registration No.

DUPLICATE THIS PAGE AS NECESSARY FOR LISTING ADDITIONAL SUBCONTRACTORS

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VERIFICATION OF CONTRACTOR AND SUBCONTRACTORS' DIR REGISTRATION

I am the _____ of _____ ("Bidder")
(Title/Position) (Bidder Name)
submitting the accompanying Bid Proposal for the Work described as:

BID # 2024-19 AG TECH PROJECT

1. The Bidder is currently registered as a contractor with the Department of Industrial Relations ("DIR").
2. The Bidder's DIR Registration Number is: _____. The expiration date of the Bidder's DIR Registration is June 30, 20___.
3. If the expiration date of the Bidder's DIR Registration will occur prior to expiration of the Contract Time for the Work and the Bidder is awarded the Contract for the Work, prior to the Bidder's DIR Registration expiration, the Bidder will take all measures necessary to renew the Bidder's DIR Registration so that there is no lapse in the Bidder's DIR Registration.
4. The Bidder, if awarded the Contract for the Work will remain a DIR registered contractor for the entire duration of the Work.
5. The Bidder has independently verified that each Subcontractor identified in the Subcontractors List is currently a DIR registered contractor.
6. The Bidder's solicitation of subcontractor bids included notice to prospective subcontractors that: (i) all sub-tier subcontractors must be DIR registered contractors at all times during performance of the Work; and (ii) prospective subcontractors may only solicit sub-bids from and contract with lower-tier subcontractors who are DIR registered contractors.
7. If any of the statements herein are false or omit material facts rendering a statement to be false or misleading, the Bidder's Bid Proposal is subject to rejection for non-responsiveness.
8. I have personal first hand-knowledge of all of the foregoing.

I declare under penalty of perjury under California law that the foregoing is true and correct.

Executed this ____ day of _____, 20___ at _____.
(City and State)

_____
(Signature)

_____
(Name, typed or printed)

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STATEMENT OF QUALIFICATIONS

1. Bidder Information.

1.1. Contact Information

Mailing Address	_____ Street Address _____ City, State, Zip Code
Physical Location (if different from mailing address)	_____ Street Address _____ City, State, Zip Code
Telephone/Fax	(_____) _____ Telephone (_____) _____ Fax

1.2. Bidder Contacts.

Name	_____
Contact Information	Telephone: (_____)_____ Fax (_____)_____ Email _____

1.3. California Contractors' License.

License Number(s)	_____
License Classification(s)	_____
Responsible Managing Employee; Responsible Managing Officer	_____
Expiration Date(s)	_____

1.4. Bidder Form of Entity.

- ☐ Corporation
- ☐ General Partnership
- ☐ Limited Partnership
- ☐ Limited Liability Company
- ☐ Limited Liability Partnership
- ☐ Joint Venture
- ☐ Sole Proprietorship

[CONTINUED NEXT PAGE]

2. Revenue. Complete the following for the Applicant's construction operations; if any portion of the revenue disclosed is generated by non-construction operations or activities, the Applicant must identify the portion of revenue attributed to construction operations and generally describe business activities of the Applicant that generates non-construction operations related revenue.

Calendar Year/ Fiscal Year	Annual Gross Revenue	Average Dollar Value of all Contracts	Dollar Value of Largest Contract
Choose an item.			
Choose an item.			
Choose an item.			

3. References.

DSA Project Inspectors			
Firm Name	Address	Telephone No.	Contact Name
Owners (K-12 school districts or community colleges preferred)			
Owner Name	Address	Telephone No.	Contact Name
Architects (K-12 or Community College Projects)			
Architect Firm Name & Architect Firm Contact Name	Address	Telephone No.	Contact Name

[CONTINUED NEXT PAGE]

4. Insurance.

Commercial General Liability Insurance	Insurer: _____ Policy No. _____ Broker _____
Commercial General Liability Insurance Broker	(Contact Name) _____ _____ (Street Address) _____ (City, State & Zip Code) (_____) _____ (_____) _____ Telephone Fax _____ (Email address)
Bid, Performance and Labor & Materials Payment Bond Surety	Surety: _____ Surety Broker _____ _____ (Surety Broker Contact Name) _____ (Street Address) _____ (City, State & Zip Code) (_____) _____ (_____) _____ Telephone Fax _____ (Email address)
Workers Compensation Insurance	Insurer: _____ Policy No. _____ Broker _____
Workers Compensation Insurance Broker	(Contact Name) _____ _____ (Street Address) _____ (City, State & Zip Code) (_____) _____ (_____) _____ Telephone Fax _____ (Email address)

[CONTINUED NEXT PAGE]

5. Essential Requirements. A Bidder will not be deemed qualified if the answer to any of the following questions results in a "not qualified" response and the Bid Proposal submitted by such a Bidder will be rejected for non-responsiveness.

5.1. Bidder possesses a valid and currently in good standing California Contractors' license for the Classification(s) of Contractors' License required by the Call for Bids.
__ Yes __ No (Not Qualified)

5.2. Bidder is currently a DIR Registered contractor.
__ Yes __ No (Not Qualified)

5.3. Bidder has a current commercial general liability insurance policy with coverage limits which are equal to or greater than minimum coverage limits set forth in the Special Conditions.
__ Yes __ No (Not Qualified)

5.4. Bidder has a current workers' compensation insurance policy as required by the Labor Code or is legally self-insured pursuant to Labor Code §3700.
__ Yes __ No (Not Qualified)
__ Bidder is exempt from this requirement, because it has no employees

5.5. The Bidder ineligible or debarred from submitting Bid Proposals for public works projects or public works contracts pursuant Labor Code §1777.1 or Labor Code §1777.7.
__ Yes (Not Qualified) __ No

5.6. A public agency, within the past five (5) years conducted proceedings that resulted in a finding that the Bidder, or any predecessor to the Bidder, is not a "responsible" bidder for a public works project or a public works contract.
__ Yes (Not Qualified) __ No

5.7. During the last five (5) years, the Bidder or any predecessor to the Bidder, or any of the equity owners of the Bidder has been convicted of a federal or state crime involving fraud, theft, or any other act of dishonesty?
__ Yes (Not Qualified) __ No

5.8. During the past five (5) years a Surety has completed any project or the Bidder's obligations under a construction contract.
__ Yes (Not Qualified) __ No

5.9. During the past five (5) years the Bidder has been declared in default under any construction contract to which the Bidder was a party.
__ Yes (Not Qualified) __ No

5.10. The Bidder's Worker's Compensation Insurance average Experience Modification Rating ("EMR") rating over the past five (5) years is more than 1.25.
__ Yes (Not Qualified) __ No

5.11. The Bidder's Workers Compensation Insurance EMR for the current policy term is more than 1.25.
__ Yes (Not Qualified) __ No

6. Accuracy and Authority. The undersigned is duly authorized to execute this Statement of Qualifications under penalty of perjury on behalf of the above-identified Bidder. The undersigned warrants and represents that he/she has personal knowledge of each of the responses to this Statement of Qualifications and/or that he/she has conducted all necessary and appropriate inquiries to determine the truth, completeness and accuracy of responses to this Statement of Qualifications. The undersigned declares and certifies that the responses to this Statement of Qualifications are complete and accurate; there are no omissions of material fact or information that render any response to be false or misleading and there are no misstatements of fact in any of the responses. The above-identified

Bidder acknowledges and agrees that if the District determines that any response herein is false or misleading or contains misstatements of fact so as to be false or misleading, the Bidder's Bid Proposal may be rejected by the District for non-responsiveness.

Executed this___ day of _____ 20__ at_____.
(City and State)

I declare under penalty of perjury under California law that the foregoing is true and correct.

By: _____
(Signature of Bidder's Authorized Officer or Representative)

_____

Title: _____
(Typed or Printed Name)

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NON-COLLUSION AFFIDAVIT

STATE OF CALIFORNIA
COUNTY OF _____

I, _____, being first duly sworn, deposes and says that I am
(Typed or Printed Name)

the _____ of _____, the party submitting
(Title) (Bidder Name)

the foregoing Bid Proposal ("the Bidder"). In connection with the foregoing Bid Proposal, the undersigned declares, states and certifies that:

1. The Bid Proposal is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization or corporation.

2. The Bid Proposal is genuine and not collusive or sham.

3. The Bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any other bidder or anyone else to put in sham bid, or to refrain from bidding.

4. The Bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price, or that of any other bidder, or to fix any overhead, profit or cost element of the bid price or that of any other bidder, or to secure any advantage against the public body awarding the contract or of anyone interested in the proposed contract.

5. All statements contained in the Bid Proposal and related documents are true.

6. The bidder has not, directly or indirectly, submitted the bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any person, corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

Executed this ____ day of _____, 20__ at _____.
(City, County and State)

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

_____
Signature

_____
Name Printed or Typed

(_____) _____
(Area Code and Telephone Number)

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CERTIFICATE OF WORKERS' COMPENSATION INSURANCE

I,_____ the _____ of
(Name) (Title)
_____, declare, state and certify that:
(Contractor Name)

1. I am aware that California Labor Code § 3700(a) and (b) provides:

"Every employer except the state shall secure the payment of compensation in one or more of the following ways:

(a) By being insured against liability to pay compensation in one or more insurers duly authorized to write compensation insurance in this state.

(b) By securing from the Director of Industrial Relations a certificate of consent to self-insure either as an individual employer, or one employer in a group of employers, which may be given upon furnishing proof satisfactory to the Director of Industrial Relations of ability to self-insure and to pay any compensation that may become due to his or her employees."

2. I am aware that the provisions of California Labor Code §3700 require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of this Contract.

_____
(Contractor Name)

By:_____
(Signature)

_____
(Typed or printed name)

DRUG-FREE WORKPLACE CERTIFICATION

I, _____, am the_____of
(Print Name) (Title)

_____
(Contractor Name)

I declare, state and certify to all of the following:

1. I am aware of the provisions and requirements of California Government Code §§8350 et seq.,the Drug Free Workplace Act of 1990.

2. I am authorized to certify, and do certify, on behalf of Contractor that a drug free workplace willbe provided by Contractor by doing all of the following:

   A. Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensation, possession or use of a controlled substance is prohibited in Contractor's workplace and specifying actions which will be taken against employees for violation of the prohibition;

   B. Establishing a drug-free awareness program to inform employees about all of the following:

      i. The dangers of drug abuse in the workplace;

      ii. Contractor's policy of maintaining a drug-free workplace;

      iii. The availability of drug counseling, rehabilitation and employee-assistance programs; and

      iv. The penalties that may be imposed upon employees for drug abuse violations;

   C. Requiring that each employee engaged in the performance of the Contract be given a copyof the statement required by subdivision (A), above, and that as a condition of employmentby Contractor in connection with the Work of the Contract, the employee agrees to abide by the terms of the statement.

   D. Contractor agrees to fulfill and discharge all of Contractor's obligations under the terms and requirements of California Government Code §8355 by, inter alia, publishing a statement notifying employees concerning: (i) the prohibition of any controlled substance in the workplace, (ii) establishing a drug-free awareness program, and (iii) requiring that each employee engaged in the performance of the Work of the Contract be given a copy of the statement required by California Government Code §8355(a) and requiring that the employee

agree to abide by the terms of that statement.

3. Contractor and I understand that if the District determines that Contractor has either: (i) made a false certification herein, or (ii) violated this certification by failing to carry out and to implementthe requirements of California Government Code §§8355, the Contract awarded herein is subject to termination, suspension of payments, or both. Contractor and I further understand that, should Contractor violate the terms of the Drug-Free Workplace Act of 1990, Contractor may be subject to debarment in accordance with the provisions of California Government Code §§8350, et seq.
4. Contractor and I acknowledge that Contractor and I are aware of the provisions of California Government Code §§8350, et seq. and hereby certify that Contractor and I will adhere to, fulfill, satisfy and discharge all provisions of and obligations under the Drug-Free Workplace Act of 1990.

I declare under penalty of perjury under the laws of the State of California that all of the foregoingis true and correct.

Executed at_____this____day of

1. (City and State)

_____, 20____.

_____

(Signature)

_____

(Printed or Typed Name)

AGREEMENT

THIS AGREEMENT is entered into Click here to enter a date. in the City of Merced, County of Merced, State of California, by and between **MERCED COMMUNITY COLLEGE DISTRICT**, a California Community College District hereinafter "District" and _____ ("Contractor").

WITNESSETH, that the District and the Contractor in consideration of the mutual covenants contained herein agree as follows:

The Work. Within the Contract Time and for the Contract Price, subject to adjustments thereto pursuant to the Contract Documents, the Contractor shall perform and provide all necessary labor, materials, tools, equipment, utilities, services and transportation to complete in a workmanlike manner all of the Work required in connection with the work of improvement commonly referred to as:

BID # 2024-19 AG TECH PROJECT

1. Contractor shall complete all Work covered by the Contract Documents, including without limitation, the Drawings and Specifications prepared by the Architect, _____ and other Contract Documents enumerated in Article 5 below, along with all modifications and addenda thereto issued in accordance with the Contract Documents.

2. Contract Time. The Work shall be commenced on the date stated in the District's Notice to Proceed; the Contractor shall achieve Completion of the Work within the Contract Time set forth in the Contract Documents.

3. Contract Price. The District shall pay the Contractor as full consideration for the Contractor's full, complete and faithful performance of the Contractor's obligations under the Contract Documents, subject to adjustments of the Contract Price in accordance with the Contract Documents, the Contract Price of _____ **Dollars ($**_____**)**. The District's payment of the Contract Price shall be in accordance with the Contract Documents. The Contract Price is based upon the Contractor's Base Bid Proposal and the following Alternate Bid Items, if any: _____.

4. Liquidated Damages. If the Contractor fails to achieve Completion of the Work within the Contract Time, including adjustments thereto authorized by the Contract Documents, the Contractor shall be subject to assessment of Liquidated Damages in accordance with the Contract Documents. Failure of the Contractor to complete Punchlist items noted upon Completion within the time established to complete the Punchlist items will result in the District's assessment of Liquidated Damages in accordance with the Contract Documents.

5. The Contract Documents. The documents forming a part of the Contract Documents consist of the following, all of which are component parts of the Contract Documents.

Section	Description		Section	Description
00 01 10	Table of Contents		00 61 10	Bid Bond
00 11 13	Notice Calling for Bids		00 61 13	Performance Bond
00 21 13	Instructions for Bidders		00 61 14	Labor & Materials Payment Bond
00 41 22	Bid Proposal		00 62 90	Verification of Certified Payroll Records Submittal to Labor Commissioner
00 43 13	Bid Proposal; Alternate Bid Items Proposal		00 65 01	Conditional Waiver & Release on Progress Payment
00 43 36	Subcontractors List		00 65 02	Unconditional Waiver & Release on Progress Payment
00 45 10	DIR Registration Verification		00 65 03	Conditional Waiver & Release on Final Payment
00 45 13	Statement of Qualifications		00 65 04	Unconditional Waiver & Release on Final Payment
00 45 19	Non-Collusion Affidavit		00 65 36	Contractor Guarantee Form
00 45 23	Certificate of Workers Compensation Insurance		00 65 37	Contractor Certification of Subcontractor Claim
00 45 27	Drug-Free Workplace		00 72 13	General Conditions

Section	Description		Section	Description
	Certification			
00 52 00	Agreement		00 73 13	Special Conditions
			00 74 00	EDA Contracting Guidelines

6. Authority to Execute. The individual(s) executing this Agreement on behalf of the Contractor is/are duly and fully authorized to execute this Agreement on behalf of Contractor and to bind the Contractor to each and every term, condition and covenant of the Contract Documents.

CONTRACTORS ARE REQUIRED BY LAW TO BE LICENSED AND REGULATED BY THE CONTRACTORS' STATE LICENSE BOARD. ANY QUESTIONS CONCERNING A CONTRACTOR MAY BE REFERRED TO THE REGISTRAR, CONTRACTORS' STATE LICENSE BOARD, P.O. BOX 2600, SACRAMENTO, CALIFORNIA 95826

IN WITNESS WHEREOF, this Agreement has been duly executed by the District and the Contractor as of the date set forth above.

District
Merced Community College District

By: _____

Title: _____

Contractor
[Contractor Name]

By: _____

Title: _____

BID BOND

KNOW ALL MEN BY THESE PRESENTS that we, _____, as Surety and _____, as Principal, are jointly and severally, along with their respective heirs, executors, administrators, successors and assigns, held and firmly bound unto **MERCED COMMUNITY COLLEGE DISTRICT** ("the Obligee") for payment of the penal sum hereof in lawful money of the United States, as more particularly set forth herein.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT:

WHEREAS, the Principal has submitted the accompanying Bid Proposal to the Obligee for the Work commonly described as **BID # 2024-19 AG TECH PROJECT**

WHEREAS, subject to the terms of this Bond, the Surety and the Principal are jointly and severally firmly bound unto the Obligee in the penal sum equal to Ten Percent (10%) of the maximum amount of the Bid Proposal submitted by the Principal to the Obligee, inclusive of amounts proposed for Alternate Bid Items, if any.

NOW THEREFORE, if the Principal shall not withdraw said Bid Proposal within the period specified therein after the opening of the same, or, if no period be specified, for sixty (60) days after opening of said Bid Proposal; and if the Principal is awarded the Contract, and shall within the period specified therefore, or if no period be specified, within five (5) days after the prescribed forms are presented to him for signature, enter into a written contract with the Obligee, in accordance with the Bid Proposal as accepted and give such bond(s) with good and sufficient surety or sureties, as may be required, for the faithful performance and proper fulfillment of such Contract and for the payment for labor and materials used for the performance of the Contract, or in the event of the withdrawal of said Bid Proposal within the period specified for the holding open of the Bid Proposal or the failure of the Principal to enter into such Contract and give such bonds within the time specified, if the Principal shall pay the Obligee the difference between the amount specified in said Bid Proposal and the amount for which the Obligee may procure the required Work and/or supplies, if the latter amount be in excess of the former, together with all costs incurred by the Obligee in again calling for Bids, then the above obligation shall be void and of no effect, otherwise to remain in full force and effect.

Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or the Call for Bids, the Work to be performed there under, the Drawings or the Specifications accompanying the same, or any other portion of the Contract Documents shall in no way affect its obligations under this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of said Contract, the Call for Bids, the Work, the Drawings or the Specifications, or any other portion of the Contract Documents.

If suit or other proceeding is brought upon this Bond by the Obligee, the Surety and Principal shall be jointly and severally liable for payment to the Obligee all costs, expenses and fees

[CONTINUED NEXT PAGE]

incurred by the Obligee in connection therewith, including without limitation, attorneys' fees.

IN WITNESS WHEREOF, the Principal and Surety have executed this instrument this _____ day of _____, 20___ by their duly authorized agents or representatives.

_____
(Bidder/Principal Name)

By: _____
(Signature)

_____
(Typed or Printed Name)

Title: _____

(Attach Notary Public Acknowledgement of Principal's Signature)

_____
(Surety Name)

By: _____
(Signature of Attorney-In-Fact for Surety)

_____
(Typed or Printed Name of Attorney-In-Fact)

(Attach: (i) Attorney-In-Fact Certification; (ii) Notary Public Acknowledgment of Authorizing Signature on Attorney-Fact Certification; and (iii) Notary Public Acknowledgement of Attorney-In-Fact's Signature.)

Contact name, address, telephone number and email address for notices to the Surety

_____
(Contact Name)

_____
(Street Address)

_____
(City, State & Zip Code)

(_____) _____ (_____) _____
Telephone Fax

_____
(Email address)

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS that we, _____, as Surety and _____, as Principal, are jointly and severally, along with their respective heirs, executors, administrators, successors and assigns, held and firmly bound unto **MERCED COMMUNITY COLLEGE DISTRICT** ("the Obligee") for payment of the penal sum the penal sum of _____ Dollars ($_____) in lawful money of the United States, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT:

WHEREAS, the Obligee, by resolution of its Board of Trustees has awarded to the Principal a Contract for the Work described as **BID # 2024-19 AG TECH PROJECT**

WHEREAS, the Principal, has entered into an agreement with the Obligee for performance of the Work; the Agreement and all other Contract Documents set forth therein are incorporated herein and made a part hereof by this reference.

WHEREAS, by the terms of the Contract Documents, the Principal is required to furnish a bond ensuring the Principal's prompt, full and faithful performance of the Work of the Contract Documents.

NOW THEREFORE, if the Principal promptly, fully and faithfully performs each and all of the obligations and things to be done and performed by the Principal in strict accordance with the terms of the Contract Documents as they may be modified or amended from time to time; and if the Principal shall indemnify, defend and hold harmless the Obligee and all of its officers, agents and employees from any and all losses, liability and damages, claims, judgments, liens, costs, and fees of every description, which may be incurred by the Obligee by reason of the failure or default on the part of the Principal in the performance of any or all of the terms or the obligations of the Contract Documents, including all modifications, and amendments, thereto, and any warranties or guarantees required thereunder; then this obligation shall be void; otherwise, it shall be, and remain, in full force and effect.

The Surety, for value received, stipulates and agrees that no change, adjustment of the Contract Time, adjustment of the Contract Price, alterations, deletions, additions, or any other modifications to the terms of the Contract Documents, the Work, or to the Specifications or the Drawings shall limit, restrict or otherwise impair Surety's obligations or Obligee's rights hereunder; Surety waives notice from the Obligee of any such changes, adjustments of Contract Time, adjustments of Contract Price, alterations, deletions, additions or other modifications to the Contract Documents, the Work, or the Drawings or the Specifications.

In the event of the Obligee's termination of the Contract due to the Principal's breach or default of the Principal's obligations thereunder, within twenty (20) days after written notice from the Obligee to the Surety of the Principal's breach or default of the Contract Documents and Obligee's termination of the Contract, the Surety shall notify Obligee in writing of Surety's assumption of obligations hereunder by its election to either remedy the default or breach of the Principal or to take charge of the Work of the Contract Documents and complete the Work at its own expense ("the Notice of Election"); provided, however, that the procedure by which the Surety undertakes to discharge its obligations under this

[CONTINUED NEXT PAGE]

Bond shall be subject to the advance written approval of the Obligee, which approval shall not be unreasonably withheld, limited or restricted. The insolvency of the Principal or the Principal's denial of a failure of performance or default under the Contract Documents shall not by itself, without the Surety's prompt, diligent inquiry and investigation of such denial, be justification for Surety's failure to give the Notice of Election or for its failure to promptly remedy the failure of performance or default of the Principal or to complete the Work.

If the Surety fails to issue its Notice of Election to Obligee within the time provided for hereinabove, the Obligee may thereafter cause the cure or remedy of the Principal's failure of performance or default or to complete the Work. The Principal and the Surety are jointly and severally liable to the Obligee for all damages and costs sustained by the Obligee as a result of the Principal's failure of performance under the Contract Documents or default in its performance of obligations thereunder, including without limitation the costs of cure or completion of the Work exceeding the then remaining balance of the Contract Price; provided that the Surety's liability hereunder for the costs of performance, damages and other costs sustained by the Obligee upon the Principal's failure of performance or default under the Contract Documents is limited to the penal sum hereof, which includes the costs or value of any Changes to the Work which increases the Contract Price.

If suit or other proceeding is brought upon this Bond by the Obligee, the Surety and Principal are jointly and severally liable for payment to the Obligee of all costs, expenses and fees incurred by the Obligee therewith, including without limitation, attorneys' fees.

IN WITNESS WHEREOF, the Principal and Surety have executed this instrument this _____day of _____, 20____ by their duly authorized agent or representative.

_____
(Contractor-Principal Name)

By: _____
(Signature)

_____
(Typed or Printed Name)

Title: _____

(Attach Notary Public Acknowledgement of Principal's Signature)

_____
(Surety Name)

By: _____
(Signature of Attorney-In-Fact for Surety)

_____
(Typed or Printed Name of Attorney-In-Fact)

(Attach: (i) Attorney-In-Fact Certification; (ii) Notary Public Acknowledgment of Authorizing Signature on Attorney-Fact Certification; and (iii) Notary Public Acknowledgement of Attorney-In-Fact's Signature.)

Contact name, address, telephone number and email address for notices to the Surety

_____
(Contact Name)

_____
(Street Address)

_____
(City, State & Zip Code)

(_____) _____ (_____) _____
Telephone Fax

_____
(Email address)

LABOR AND MATERIAL PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS that we, _____, as Surety and _____, as Principal, are jointly and severally, along with their respective heirs, executors, administrators, successors and assigns, held and firmly bound unto **MERCED COMMUNITY COLLEGE DISTRICT** ("the Obligee") for payment of the penal sum the penal sum of _____ Dollars ($_____) in lawful money of the United States, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT:

WHEREAS, the Obligee, by resolution of its Board of Trustees has awarded to the Principal a Contract for the Work described as **BID # 2024-19 AG TECH PROJECT**

WHEREAS, the Principal, has entered into an Agreement with the Obligee for performance of the Work, the Agreement and all other Contract Documents set forth therein are incorporated herein by this reference and made a part hereof.

WHEREAS, by the terms of the Contract Documents, the Principal is required to furnish a bond for the prompt, full and faithful payment to any Claimant, as hereinafter defined, for all labor materials or services used, or reasonably required for use, in the performance of the Work.

NOW THEREFORE, if the Principal shall promptly, fully and faithfully make payment: (i) to any Claimant for all labor, materials or services used or reasonably required for use in the performance of the Work; (ii) of amounts due under the Unemployment Insurance Code for work or labor performed under the Contract; and (iii) of amounts required to be deducted, withheld and paid to the Employment Development Department from wages of the employees of the Principal and its Subcontractors under Section 13020 of the Unemployment Insurance Code with respect to work and labor under the Contract then this obligation shall be void; otherwise, it shall be, and remain, in full force and effect.

The term "Claimant" shall refer to any person, corporation, partnership, proprietorship or other entity including without limitation, all persons and entities described in California Civil Code §9100, providing or furnishing labor, materials or services used or reasonably required for use in the performance of the Work under the Contract Documents, without regard for whether such labor, materials or services were sold, leased or rented. This Bond shall inure to the benefit of all Claimants so as to give them, or their assigns and successors, a right of action upon this Bond.

If suit is brought on this Bond by any Claimant for amounts due such Claimant for labor, materials or services provided or furnished by such Claimant, the Surety shall pay for the same and reasonable attorneys' fees pursuant to California Civil Code §9554.

The Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration, deletion, addition, or any other modification to the terms of the Contract Documents, the Work to be performed thereunder, the Specifications or the Drawings, or any other portion of the Contract Documents, shall in any way limit, restrict or otherwise affect its obligations under this Bond; the Surety hereby waives notice from the Obligee of any such change, extension of time, alteration

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deletion, addition or other modification to the Contract Documents, the Work to be performed under the Contract Documents, the Drawings or the Specifications of any other portion of the Contract Documents.

IN WITNESS WHEREOF, the Principal and Surety have executed this instrument this _____ day of _____, 20__ by their duly authorized agent or representative.

_____
(Contractor-Principal Name)

By: _____
(Signature)

_____
(Typed or Printed Name)

Title: _____

(Attach Notary Public Acknowledgement of Principal's Signature)

_____
(Surety Name)

By: _____
(Signature of Attorney-In-Fact for Surety)

_____
(Typed or Printed Name of Attorney-In-Fact)

(Attach: (i) Attorney-In-Fact Certification; (ii) Notary Public Acknowledgment of Authorizing Signature on Attorney-Fact Certification; and (iii) Notary Public Acknowledgement of Attorney-In-Fact's Signature)

Contact name, address, telephone number and email address for notices to the Surety

_____
(Contact Name)

_____
(Street Address)

_____
(City, State & Zip Code)

(_____) _____ (_____) _____
Telephone Fax

_____
(Email address)

VERIFICATION OF CERTIFIED PAYROLL RECORDS SUBMITTAL TO LABOR COMMISSIONER

I am the _____ for _____ in
(Superintendent/Project Manager) (Contractor)
connection with **BID # 2024-19 AG TECH PROJECT**

1. This Verification is submitted to Merced Community College District concurrently with the Contractor's submittal of an Application for Progress Payment to the District, identified as Application For Progress Payment No. _____ ("the Pay Application").
2. The Pay Application requests the District's disbursement of a Progress Payment for the value of Work performed between _____, 20___ and _____, 20___.
3. The Contractor has submitted Certified Payroll Records ("CPR") to the Labor Commissioner for all employees of the Contractor engaged in performance of Work subject to prevailing wage rate requirements for the period of time covered by the Pay Application.
4. All Subcontractors who are entitled to any portion of payment to be disbursed pursuant to the Pay Application have submitted their CPRs to the Labor Commissioner for all of their employees performing Work subject to prevailing wage rate requirements for the period of time covered by the Pay Application.
5. I have reviewed the Contractor's CPRs submitted to the Labor Commissioner. The CPRs submitted to the Labor Commissioner by the Contractor are complete and accurate for the period of time covered by the Pay Application.
6. I have reviewed the Subcontractors' CPRs submitted to the Labor Commissioner. The CPRs submitted to the Labor Commissioner by the Subcontractors are complete and accurate for the period of time covered by the Pay Application.

I declare under penalty of perjury under California law that the foregoing is true and correct. I executed this Certification on the ____ day of _____, 20___ at _____ _____.
(City) and State)

By: _____

_____
(Typed or Printed Name)

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CONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT (Civil Code §8132)

NOTICE: THIS DOCUMENT WAIVES THE CLAIMANT'S LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS EFFECTIVE ON RECEIPT OF PAYMENT. A PERSON SHOULD NOT RELY ON THIS DOCUMENT UNLESS SATISFIED THAT THE CLAIMANT HAS RECEIVED PAYMENT.

Identifying Information

Name of Claimant	
Name of Customer	
Job Location	
Owner	
Through Date	

Conditional Waiver and Release

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job through the Through Date of this document. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. This document is effective only on the claimant's receipt of payment from the financial institution on which the following check is drawn:

Maker of Check	
Amount of Check	
Check Payable To	

Exceptions

This document does not affect any of the following:

1. Retentions.
2. Extras for which the claimant has not received payment.
3. The following payments for which the claimant has previously given a conditional waiver and release but has not received payment:
   Date(s) of waiver and release: _____
   Amount(s) of unpaid payment(s): _____
4. Contract rights, including (A) a right based on rescission, abandonment, or breach of contract, and (B) the right to recover compensation for work not compensated by the payment.

Signature

Claimant's Signature: _____

Claimant's Title: _____

Date of Signature: _____

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UNCONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT (Civil Code §8134)

NOTICE TO CLAIMANT: THIS DOCUMENT WAIVES AND RELEASES LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. THIS DOCUMENT IS ENFORCEABLE AGAINST YOU IF YOU SIGN IT, EVEN IF YOU HAVE NOT BEEN PAID. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL WAIVER AND RELEASE FORM.

Identifying Information

Name of Claimant	
Name of Customer	
Job Location	
Owner	
Through Date	

Unconditional Waiver and Release

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job through the Through Date of this document. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. The claimant has received the following progress payment: $_____.

Exceptions

This document does not affect any of the following:

1. Retentions.
2. Extras for which the claimant has not received payment.
3. Contract rights, including (A) a right based on rescission, abandonment, or breach of contract, and (B) the right to recover compensation for work not compensated by the payment.

Signature

Claimant's Signature: _____

Claimant's Title: _____

Date of Signature: _____

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CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT (Civil Code §8136)

NOTICE: THIS DOCUMENT WAIVES THE CLAIMANT'S LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS EFFECTIVE ON RECEIPT OF PAYMENT. A PERSON SHOULD NOT RELY ON THIS DOCUMENT UNLESS SATISFIED THAT THE CLAIMANT HAS RECEIVED PAYMENT.

Identifying Information

Name of Claimant	
Name of Customer	
Job Location	
Owner	
Through Date	

Conditional Waiver and Release

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. This document is effective only on the claimant's receipt of payment from the financial institution on which the following checks are drawn:

Maker of Check	
Amount of Check	
Check Payable To	

Exceptions

This document does not affect any of the following:
Disputed claims for extras in the amount of: $_____

Signature

Claimant's Signature: _____
Claimant's Title: _____
Date of Signature: _____

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UNCONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT (Civil Code §8138)

NOTICE TO CLAIMANT: THIS DOCUMENT WAIVES AND RELEASES LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. THIS DOCUMENT IS ENFORCEABLE AGAINST YOU IF YOU SIGN IT, EVEN IF YOU HAVE NOT BEEN PAID. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL WAIVER AND RELEASE FORM.

Identifying Information

Name of Claimant	
Name of Customer	
Job Location	

Unconditional Waiver and Release

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for all labor and service provided, and equipment and material delivered, to the customer on this job. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. The claimant has been paid in full.

Exceptions

This document does not affect the following:
Disputed claims for extras in the amount of: $_____

Signature

Claimant's Signature: _____
Claimant's Title: _____
Date of Signature: _____

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Contractor Guarantee

District: **Merced Community College District**

Project Name: **BID # 2024-19 AG TECH PROJECT**

Contractor Name: _____

The Contractor hereby warrants and guarantees to the District that all work, materials, equipment and workmanship provided, furnished or installed by or on behalf of Contractor in connection with the above-referenced Project (the "Work") have been provided, furnished and installed in strict conformity with the Contract Documents for the Work, including without limitation, the Drawings and the Specifications. Contractor further warrants and guarantees that all work, materials, equipment and workmanship as provided, furnished and/or installed are fit for use as specified and fulfill all applicable requirements of the Contract Documents including without limitation, the Drawings and the Specifications. Contractor shall, at its sole cost and expense, repair, correct and/or replace any or all of the work, materials, equipment and/or workmanship of the Work, together with any other items which may be affected by any such repairs, corrections or replacement, that may be unfit for use as specified or defective within a period of one (1) year from the date of the District's Final Acceptance of the Work, ordinary wear and tear and unusual abuse or neglect excepted.

In the event of the Contractor's failure and/or refusal to comply with the provisions of this Guarantee, within the period of time set forth in the Contract Documents after the District's issuance of the Notice to the Contractor of any defect(s) in the Work, materials, equipment or workmanship, Contractor authorizes the District, without further notice to Contractor, to repair, correct and/or replace any such defective item at the expense of the Contractor. The Contractor shall reimburse the District for all costs, expenses or fees incurred by the District in providing or performing such repairs, corrections or replacements within ten (10) days of the District's presentation of a demand to the Contractor for the same.

The provisions of this Guarantee and the provisions of the Contract Documents for the Work relating to the Contractor's Guarantee(s) and warranties relating to the Work shall be binding upon the Contractor's Performance Bond Surety and all successors or assigns of Contractor and/or Contractor's Performance Bond Surety.

The provisions of this Guarantee are in addition to, and not in lieu of, any provisions of the Contract Documents for the Work relating to the Contractor's guarantee(s) and warranties or any guarantee(s) or warranties provided by any material supplier or manufacturer of any equipment, materials or other items forming a part of, or incorporated into the Work, or any other guarantee or warranty obligation of the Contractor, prescribed, implied or imposed by law.

The undersigned individual executing this Guarantee on behalf of Contractor warrants and represents that he/she is duly authorized to execute this Guarantee on behalf of Contractor and to bind Contractor to each and every provision hereof.

Dated: _____ By: _____
(Signature)

_____
(Typewritten or Handwritten Name)

_____
(Title)

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CONTRACTOR CERTIFICATION OF SUBCONTRACTOR CLAIM

TO: MERCED COMMUNITY COLLEGE DISTRICT ("DISTRICT")

RE: BID # 2024-19 AG TECH PROJECT (Project)
YYYY (Contractor)
ZZZZ (Subcontractor)
Subcontractor Claim

This Contractor Certification of Subcontractor Claim is submitted by YYYY relating to **BID # 2024-19 AG TECH PROJECT** to the District on behalf of ZZZZ.

1. I am the _____ of the Contractor in connection with the above-described Project.
2. The Subcontractor has submitted the accompanying Subcontractor Claim to the Contractor for presentation to the District pursuant to Public Contract Code §9204.
3. I have personally reviewed the entirety of the Subcontractor Claim and all substantiating documentation in support of the Subcontractor Claim.
4. The Subcontractor Claim is made by the Subcontractor in good faith.
5. The Subcontractor Claim is supported by reasonable documentation establishing entitlement to the relief requested and District liability therefor.
6. The Subcontractor Claim does not incorporate any request constituting a False Claim under applicable law, including the California False Claim Act (Government Code §12650 et. seq.).
7. I am authorized: (i) to execute this Certification on behalf of the Contractor; and (ii) to submit this Certification and the accompanying Subcontractor Claim to the District.
8. I have personal first-hand knowledge of all of the foregoing.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Executed at _____, California, on _____, 20___.

_____
(Signature)

_____
(Print Name)

_____
(Title)

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GENERAL CONDITIONS
BID # 2024-19 AG TECH PROJECT

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GENERAL CONDITIONS

ARTICLE 1: DEFINITIONS

1.1 District. The "District" refers t**o Merced Community College District** and unless otherwise stated, includes the District's authorized representatives, including the Project Manager, if a Project Manager is designated, the District's Board of Trustees and the District's officers, employees, agents and representatives.

1.2 Contractor. The Contractor is the person or entity identified as such in the Agreement; references to "Contractor" include the Contractor's authorized representative.

1.3 Architect. The Architect is the person or entity identified as such in the Agreement; references to the "Architect" include, as required by context of usage, the Architect's employees and authorized representative(s) and the Architect's Consultants and their employees and authorized representative(s).

1.4 The Work. The Work is the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment or services provided or to be provided by the Contractor to fulfill the Contractor's obligations under the Contract Documents. The Work may constitute the whole or a part of the Project.

1.5 The Project. The Project is the total construction of which the Work performed by the Contractor under the Contract Documents may be the whole or a part of the Project and which may include construction by the District or by separate contractors.

1.6 Surety. The Surety is the person or entity that executes, as surety, the Contractor's Labor and Material Payment Bond and/or Performance Bond.

1.7 Subcontractors; Sub-Subcontractors. A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work. "Subcontractor" does not include a separate contractor to the District or subcontractors of any separate contractor. A Sub-Subcontractor is a person or entity of any tier, who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the Site. References to "Subcontractor" herein include all subcontractors of any tier.

1.8 Material Supplier. A Material Supplier is any person or entity who only furnishes materials, equipment or supplies for the Work without fabricating, installing or consuming them in the Work.

1.9 Drawings and Specifications. The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing generally, the design, location and dimensions of the Work and may include without limitation, plans, elevations, sections, details, schedules or diagrams. The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards, criteria and workmanship for the Work and related services. The Drawings and Specifications are intended to delineate and describe the Work and its component parts so as to permit skilled and competent contractors to bid upon the Work and prosecute the same to completion.

1.10 Special Conditions; Supplemental Conditions. Special Conditions and/or Supplemental Conditions, if any are special or supplemental provisions, not otherwise provided for in the Agreement or the General Conditions.

1.11 Contract Documents. The Contract Documents consist of the Agreement between the District and the Contractor, Conditions of the Contract (whether General, Special, Supplemental or otherwise), Drawings, Specifications, including addenda thereto issued prior to execution of the Agreement and any other documents listed in the Agreement. The Contract Documents shall include modifications issued after execution of the Agreement. The Contract Documents form

the Contract for Construction.

1.12 Intent and Correlation of Contract Documents.

1.12.1 Work of the Contract Documents. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable therefrom as being necessary to produce the intended results. Organization of the Specifications into divisions, sections or articles, and the arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Where any portion of the Contract Documents is silent and information appears elsewhere in the Contract Documents, such other portions of the Contract Documents shall control.

1.12.2 Technical Terms. Unless otherwise stated in the Contract Documents, words or terms which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

1.12.3 Conflict in Contract Documents. Conflicts, inconsistencies or ambiguities in the Contract Documents shall be resolved by the Architect in accordance with Article 3.1.9 of the General Conditions; where conflicts or inconsistencies arise between the Drawings and the Specifications, in resolving such conflicts or inconsistencies, the Architect will be governed generally by the following standards: the Drawings are intended to describe matters relating to placement, type, quantity and the like; the Specifications are intended to describe matters relating to quality, materials, compositions, manufacturers and the like. If conflicts exist between portions of the Contract Documents regarding the quality of any item, product, equipment or materials, unless otherwise directed or authorized by the District, the Contractor shall provide the item, product, equipment or material of the highest or more stringent quality.

1.13 Shop Drawings; Samples; Product Data ("Submittals"). Shop Drawings are diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Material Supplier, or others to illustrate some portion of the Work. Samples are physical examples of materials, equipment or workmanship forming a part of, or to be incorporated into the Work. Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work. Shop Drawings, Samples and Product Data prepared or furnished by the Contractor, Subcontractors or Material Suppliers are collectively referred to as "Submittals".

1.14 Division of State Architect ("DSA"). DSA is the California Division of the State Architect including without limitation DSA's Office of Construction Services, Office of Design Services and the Office of Regulatory Services; references to the DSA in the Contract Documents shall mean the DSA, its offices and its authorized employees and agents. The authority of the DSA over the Work and the performance thereof shall be as set forth in the Contract Documents and Title 24 of the California Code of Regulations.

1.15 District's Inspector. The District's Inspector is the individual designated and employed by the District in accordance with the requirements of Title 24 of the California Code of Regulations. The District's Inspector shall be authorized to act on behalf of the District as provided for in the Contract Documents and in Title 24 of the California Code of Regulations, as the same may be amended from time to time.

1.16 Contract Document Terms. The term "provide" means "provide complete in place" or to "furnish and install" such item. Unless otherwise provided in the Contract Documents, the terms "approved;" "directed;" "satisfactory;" "accepted;" "acceptable;" "proper;" "required;" "necessary"

and "equal" shall mean as approved, directed, satisfactory, accepted, acceptable, proper, required, necessary and equal, in the opinion of the Architect. The term "typical" as used in the Drawings shall require the installation or furnishing of such item(s) of the Work designated as "typical" in all other areas similarly marked as "typical"; Work in such other areas shall conform to that shown as "typical" or as reasonably inferable therefrom.

1.17 Contractor's Superintendent. The Contractor's Superintendent is the individual employed by the Contractor whose principal responsibility shall be the supervision and coordination of the Work; the Contractor's Superintendent shall not perform routine construction labor.

1.18 Record Drawings. The Record Drawings are a set of the Drawings marked by the Contractor during the performance of the Work to indicate completely and accurately the actual as-built condition of the Work. The Record Drawings shall be sufficient for a capable and qualified draftsman to modify the Drawings to reflect and indicate the Work actually in place at Final Completion of the Work.

1.19 Project Manager. The Project Manager, if any, is the individual or entity designated as such in the Special Conditions. The Project Manager is an independent contractor retained by the District and shall be authorized and empowered to act on behalf of the District. In the event that a Project Manager is not designated in the Special Conditions, the District reserves the right to designate a Project Manager at any time during Contractor's performance of the Work. The District reserves the right to remove or replace the Project Manager during Contractor's performance of the Work. The designation of a Project Manager, if one has not been designated in the Special Conditions, or the removal or replacement of the designated Project Manager shall not result in adjustment of the Contract Price or the Contract Time or otherwise affect, limit or restrict Contractor's obligations hereunder.

1.20 Construction Equipment. Construction Equipment is equipment utilized for the performance of any portion of the Work, but which is not incorporated into the Work.

1.21 Site. The Site is the physical area designated in the Contract Documents for Contractor's performance, construction and installation of the Work.

1.22 Field Clarifications. A written or graphic document consisting of supplementary details, instructions or information issued on behalf of the District which clarifies or supplements the Contract Documents and which becomes a part of the Contract Documents upon issuance. Field Clarifications do not constitute an adjustment of the Contract Time or the Contract Price, unless a Change Order relating to a Field Clarification is authorized and issued under the Contract Documents.

1.23 Defective or Non-Conforming Work. Defective or Non-Conforming Work is any Work which is unsatisfactory, faulty or deficient by: (i) not conforming to the requirements of the Contract Documents; (ii) not conforming to the standards of workmanship of the applicable trade or industry; (iii) not being in compliance with the requirements of any inspection, reference, standard, test, or approval required by the Contract Documents; or (iv) damage occurring prior to Final Completion of all of the Work.

1.24 Delivery. Delivery used in conjunction with any equipment, materials or other items to be incorporated into the Work shall mean the unloading and storage in a protected condition at the Site pending incorporation into the Work.

1.25 Notice to Proceed. The Notice to Proceed is the written notice issued by or on behalf of the District to the Contractor authorizing the Contractor to proceed with commencement of the Work and which establishes the date for commencement of the Contract Time.

1.26 Progress Reports; Verified Reports. Progress Reports, if required, are written reports prepared by the Contractor and periodically submitted to the District in the form and content as required

by the Contract Documents. Verified Reports are periodic written reports prepared by the Contractor and submitted to the DSA; Verified Reports shall be in such form and content as required by the applicable provisions of Title 24 of the California Code of Regulations. A material obligation of the Contractor is the preparation of complete and accurate Progress Reports, if required, and Verified Reports as well as the timely submission of the same.

1.27 Laws. Laws refer to all laws, ordinances, codes, rules and/or regulations promulgated by any governmental or quasi-governmental agency with jurisdiction over any portion of the Work and which apply to any portion of the Work, including those in effect as of the execution of the Agreement, amendments thereto and subsequently enacted Laws that take effect during the performance of the Work. No adjustment of the Contract Time or the Contract Price shall be allowed for the Contractor's compliance with the Laws.

1.28 Construction Change Directive. A Construction Change Directive is a written instrument issued by or on behalf of the District to the Contractor directing a Change to the Work prior to the Contractor and District reaching full agreement on an adjustment of the Contract Time and/or Contract Price on account of such Change. A material obligation of the Contractor is timely performance of Work noted in a Construction Change Directive.

ARTICLE 2: DISTRICT

2.1 Information Required of District.

2.1.1 Surveys; Site Information. Information, if any, concerning physical characteristics of the Site, including without limitation, surveys, soils reports, and utility locations, to be provided by the District are set forth in the Contract Documents. Information not provided by the District or necessary information in addition to that provided by the District concerning physical characteristics of the Site which is required shall be obtained by Contractor without adjustment to the Contract Price or the Contract Time.

2.1.2 Permits, Licenses, Approvals. Except as otherwise provided in the Contract Documents, the District shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities which relate to the Work of the Contractor under the Contract Documents. If permits, licenses, approvals or similar approvals relating to the Work, or the installation/construction thereof are designated as the responsibility of the Contractor under the Contract Documents, the Contractor shall obtain the same without adjustment of the Contract Price or the Contract Time.

2.1.3 Drawings and Specifications. Except as otherwise provided for in the Contract Documents, the District shall furnish the Contractor, free of charge, the number of copies of the Drawings and the Specifications as set forth in the Special Conditions. All of the Drawings and the Specifications provided by the District to the Contractor remain the property of the District; the Contractor shall not use the Drawings or the Specifications in connection with any other work of improvement other than the Work.

2.1.4 Furnishing of Information. Information or services to be provided by the District under the Contract Documents shall be furnished by the District with reasonable promptness to avoid delay in the orderly progress of the Work. Information about existing conditions furnished by the District under the Contract Documents is obtained from sources believed to be reliable, but the District neither guarantees nor warrants that such information is complete and accurate. The Contractor shall verify all information provided by the District. If the Contract Documents depict existing conditions on or about the Site, or the Work involves the renovation, removal or remodeling of existing improvements or the Work involves any tie-in or other connection with existing improvements, the conditions and/or existing improvements depicted in the Contract Documents are as they are believed to exist. The Contractor shall bear the risk of any variations

between conditions or existing improvements depicted in the Contract Documents and those conditions or existing improvements actually encountered in the performance of the Work. The existence of any variations between conditions or existing improvements depicted in the Contract Documents and those actually encountered in the performance of the Work shall not result in any District liability therefor, nor shall any such variations result in an adjustment of the Contract Time or the Contract Price.

2.2 District's Right to Stop the Work. In addition to the District's right to suspend the Work or terminate the Contract pursuant to the Contract Documents, the District, may, by written order, direct the Contractor to stop the Work, or any portion thereof, until the cause for such stop work order has been eliminated if the Contractor: (i) fails to correct Work which is not in conformity and in accordance with the requirements of the Contract Documents, or (ii) otherwise fails to carry out the Work in conformity and accordance with the Contract Documents. The right of the District to stop the Work hereunder shall not be deemed a duty on the part of the District to exercise such right for the benefit of the Contractor or any other person or entity, nor shall the District's exercise of such right: (i) waive or limit the exercise of any other right or remedy of the District under the Contract Documents or the Laws; or (ii) result in adjustment of the Contract Time or Contract Price.

2.3 Partial Occupancy or Use.

2.3.1 District's Right to Partial Occupancy. The District may occupy or use any completed or partially completed portion of the Work, provided that: (i) the District has obtained the consent of, or is otherwise authorized by, public authorities with jurisdiction thereof, to so occupy or use such portion of the Work and (ii) the District and the Contractor have accepted, in writing, the responsibilities assigned to each of them for security, maintenance, utilities, damage to the Work, insurance, the period for correction of the Work and commencement of warranties required by the Contract Documents for such portion of the Work partially used or occupied by the District. If the Contractor and the District are unable to agree upon the matters set forth in (ii) above, the District may nevertheless use or occupy any portion of the Work, with the responsibility for such matters subject to resolution in accordance with the Contract Documents. Immediately prior to such partial occupancy or use of the Work, or portions thereof, the District, the District's Inspector, the Contractor and the Architect shall jointly inspect the portions of the Work to be occupied or to be used to determine and record the condition of the Work. Repairs, replacements or other corrective action noted in such inspection shall be promptly performed and completed by the Contractor so that the portion of the Work to be occupied or used by the District is in conformity with the requirements of the Contract Documents and the District's occupancy or use thereof is not impaired. The District's use or occupancy of the Work or portions thereof pursuant to the preceding shall not be deemed "completion" of the Work as that term is used in Public Contract Code §7107.

2.3.2 No Acceptance of Defective or Nonconforming Work. The District's partial occupancy or use of the Work or any portion thereof, shall not constitute the District's acceptance of the Work which is defective or non-conforming.

2.4 District's Inspector.

2.4.1 Authority of District's Inspector. In addition to the authority and rights of the District's Inspector as provided for elsewhere in the Contract Documents and/or the Laws, all of the Work shall be performed under the observation of the District's Inspector. The foregoing notwithstanding, the Contractor shall not perform any Work deviating from the Contract Documents solely on the basis of direction by the District's Inspector; such deviations shall be deemed defective or non-conforming Work subject to correction or replacement at the sole cost of the Contractor and without adjustment of the Contract Time. The performance of the duties of the District's Inspector shall not relieve or limit the Contractor's performance of its obligations under the Contract Documents.

2.4.2 Limitations on District's Inspector. The does not have authority to interpret the Contract Documents or to modify the Work depicted in the Contract Documents. The District's Inspector has no authority relative to the content or scope of the Contractor's safety plan/program. The Contractor shall not perform any Work deviating from the Contract Documents solely on the basis of direction by the District's Inspector; such deviations shall be deemed Defective or Non-Conforming Work subject to correction or replacement at the sole cost of the Contractor and without adjustment of the Contract Time.

2.4.3 Contractor Access for District's Inspector. The Contractor shall provide the District's Inspector with access to all parts of the Work at any time, wherever located and whether partially or completely fabricated, manufactured, furnished or installed.

2.4.4 Contractor and District Responsibilities for Costs and Fees of District's Inspector. The District is responsible only for payment of the fees of the District's Inspector for standard eight (8) hour work day Mondays through Fridays, excepting holiday days ("District's Inspector Standard Workdays"). Unless the District directs the Contractor to perform Work exceeding the District's Inspector Standard Workdays, for any Work performed by the Contractor outside the District's Inspector Standard Workdays, the Contractor shall be responsible for payment of District's Inspector fees for District's Inspector services relating to such Work. All services provided by the District's Inspector exceeding an eight (8) hour workday Mondays through Fridays and/or the first eight (8) hours on Saturdays shall be at one and one-half (1½) times the District's Inspector's basic hourly rate. All hours of service provided by the District's Inspector in excess of eight (8) hours on Saturdays, and all hours of service provided by the District's Inspector on holiday days or on Sundays are at two (2) times the District's Inspector's basic hourly rate. Fees for services provided by the District's Inspector beyond the District's Inspector Standard Workdays set forth above are the sole responsibility of the Contractor; the District may deduct such fees from the Contract Price then or thereafter due the Contractor.

ARTICLE 3: ARCHITECT

3.1 Architect's Administration of the Contract.

3.1.1 Administration of Contract. The Architect will provide administration of the Contract as described in the Contract Documents, and will be one of the District's representatives during construction until the time that Final Payment. The Architect will advise and consult with the District, the Project Manager, if any, and the District's Inspector with respect to the administration of the Contract and the Work. The Architect is authorized to act on behalf of the District to the extent provided for in the Contract Documents; and shall have the responsibilities and authority established by the Laws.

3.1.2 Periodic Site Inspections. The Architect will visit the Site at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the completed Work and to determine, in general, if the Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Contract Documents. The Architect is not required to make exhaustive or continuous Site inspections to check quality or quantity of the Work. On the basis of Site observations as an architect, the Architect will keep the District informed of the progress of the Work, and will endeavor to guard the District against defects and deficiencies in the Work.

3.1.3 Contractor Responsibility for Construction Means, Methods and Sequences. The Architect will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, these being solely the Contractor's responsibility. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons performing portions of the Work.

3.1.4 Review of Applications for Payment. Pursuant to Article 8 hereof, the Architect will

review the Contractor's Payment Applications and for Final Payment, evaluate the extent of Work performed and verify to the District the amount properly due the Contractor on such Application for Payment.

3.1.5 Rejection of Work. The Architect is authorized to reject Work which is defective or does not conform to the requirements of the Contract Documents. Whenever the Architect considers it necessary or advisable, for implementation of the intent of the Contract Documents, the Architect is authorized to require additional inspections or testing of the Work, whether or not such Work is fabricated, installed or completed. Neither this authority of the Architect nor a decision made in good faith by the Architect to exercise or not to exercise such authority shall modify requirements of the Contract Documents or any obligation of the Contractor under the Contract Documents.

3.1.6 Submittals.

3.1.6.1 Architect's Review. The Architect will review and approve or take other appropriate action upon Submittals for the limited purpose of checking for general conformance with information given and the design concept expressed in the Contract Documents. Review of Submittals is not for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor. The Architect's review of the Contractor's Submittals shall not: (i) modify or limit the Contractor's obligations under the Contract Documents; (ii) requirements of the Contract Documents relating to the Work; (iii) approval of safety measures, programs or precautions; or (iv) construction means, methods, techniques, sequences or procedures. The Architect's acceptance of a specific item in a Submittal shall not indicate approval of an assembly of which the item is a component with the Submittal(s) required and relating to such assembly have been reviewed by the Architect.

3.1.6.2 Time for Architect's Review. The Architect's review of Submittals will be conducted promptly so as not to delay or hinder the progress of the Work or the activities of the Contractor, the District or the District's separate contractors while allowing sufficient time, in the Architect's reasonable professional judgment, to permit adequate review of Submittals. The foregoing notwithstanding, the Architect's review and return of Submittals will conform with the time limits and other conditions, if any, set forth in the Specifications or the Submittal Schedule if the Submittal Schedule is required by other provisions of the Contract Documents.

3.1.7 Issuance of Construction Change Directive. The Architect is authorized to issue Construction Change Directives.

3.1.8 Changes to the Work; Change Orders. The Architect will prepare Change Orders, and may authorize minor Changes in the Work which do not result in adjustment of the Contract Time or the Contract Price.

3.1.9 Completion. In conjunction with the District, District's Inspector, Project Manager, if any, and the Contractor, the Architect will conduct observations of the Work to determine the date(s) of Completion and Final Completion. If the District does not designate a Project Manager for the Work, the Architect shall: (i) be authorized to enforce the Contractor's close-out obligations; and (ii) receive from the Contractor and the records, written warranties and related close-out materials assembled by the Contractor in accordance with the Contract Documents.

3.1.10 Interpretation of Contract Documents. The Architect will interpret and decide matters concerning the requirements of the Contract Documents on written request of either the District or the Contractor. The Architect's response to such requests will be made with reasonable promptness and within the time limits agreed upon, if any. If no agreement is reached establishing the time for the Architect's review and response to requests under this Article 3.1.10, the Architect shall be afforded a fifteen (15) day period after receipt of such request to review and respond thereto. Interpretations and decisions of the Architect will: (i) be consistent

with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions; (ii) endeavor to secure faithful performance by both the District and the Contractor; (iii) not show partiality to either the District or Contractor; and (iv) not result in liability for results of interpretations or decisions so rendered in good faith. The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

3.1.11 Request for Information. If the Contractor encounters any condition which the Contractor believes, in good faith and with reasonable basis, is the result of an ambiguity, conflict, error or omission in the Contract Documents (collectively "the Conditions"), Contractor shall timely notify the Architect, in writing, of the Conditions encountered and to request information from the Architect necessary to address and resolve any such Conditions before proceeding with any portion of the Work affected or which may be affected by such Conditions. If the Contractor fails to timely notify the Architect in writing of any Conditions encountered and the Contractor proceeds to perform any portion of the Work containing or affected by such Conditions the Contractor shall bear all costs associated with or required to correct, remove, or otherwise remedy any portion of the Work affected thereby without adjustment of the Contract Time or the Contract Price. In requesting information of the Architect to address and resolve any Conditions the Contractor shall act with promptness in submitting any such written request so as to allow the Architect a reasonable period of time to review, evaluate and respond to any such request, taking into account the then current status of the progress and completion of the Work and the actual or potential impact of any such Conditions upon the completion of the Work within the Contract Time. The Contract Time shall not be subject to adjustment in the event that the Contractor shall fail to timely request information from the Architect. The Architect's responses to any such Contractor request for information shall conform to the standards and time frame set forth in Article 3.1.10 of these General Conditions. The foregoing provisions notwithstanding, if the Architect reasonably determines that any of Contractor's request(s) for information: (i) does not reflect adequate or competent supervision or coordination by the Contractor or any Subcontractor; (ii) does not reflect the Contractor's adequate or competent knowledge of the requirements of the Work or the Contract Documents; or (iii) is not justified for any other reason, Contractor shall be liable to the District for all costs incurred by the District associated with the processing, reviewing, evaluating and responding to any such request for information, including without limitation, fees of the Architect. In responding to any of Contractor's request(s) for information, the Architect shall, in the response, indicate if the Architect has made the determination pursuant to the preceding sentence and, if so, the costs to be borne by the Contractor for the processing, review, evaluation and response to the request for information. Thereafter, the District is authorized to deduct such costs from any portion of the Contract Price then or thereafter due the Contractor.

3.2 Communications; Architect's Role. All communications regarding the Work, the performance thereof or the Contract Documents shall be in writing; verbal communications shall be reduced to writing. If the District does not designate a Project Manager for the Work, communications between the Contractor and the District shall be through the Architect. Communications between separate contractors, if any, shall be through the Architect.

3.3 Termination of Architect; Substitute Architect. In case of termination of employment of the Architect, the District shall appoint a substitute architect whose status under the Contract Documents shall be that of the Architect.

3.4 Project Manager. If a Project Manager is designated for the Work, the Project Manager shall be a representative of the District until Final Completion is achieved and Final Payment is due the Contractor. The Project Manager is authorized to act on behalf of the District and in connection with the Work as set forth in the Contract Documents, including without limitation: (i) review of the Contractor's Construction Schedule and updates thereto; (ii) review of the Contractor's Applications for

Payment and verification of the amount due the Contractor under an Application for Payment; (iii) conducting the Pre-Construction Meeting, Progress Meetings and/or Special Meetings and maintaining minutes thereof; and (iv) enforcement of the Contractor's obligations under the Contract Documents, including the Contractor's close-out obligations.

ARTICLE 4: THE CONTRACTOR

4.1 Contractor Review of Contract Documents.

4.1.1 Examination of Contract Documents. The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the District pursuant to the Contract Documents and shall at once report to the Architect any errors, inconsistencies or omissions discovered. If the Contractor performs any Work knowing, or with reasonable diligence should have known that, it involves an error, inconsistency or omission in the Contract Documents without prior notice to the Architect of the same, the Contractor shall assume full responsibility for such performance and shall bear all costs for correction of the same without adjustment of the Contract Price.

4.1.2 Field Measurements. Prior to commencement of the Work, or portions thereof, the Contractor shall take field measurements and verify field conditions at the Site and shall carefully compare such field measurements and conditions with information provided in the Contract Documents. Errors, inconsistencies or omissions discovered shall be immediately reported to the Architect along with request for clarification or direction.

4.1.3 Dimensions; Layouts and Field Engineering. Unless otherwise expressly provided, dimensions indicated in the Drawings are intended for reference only. The Drawings are intended to be diagrammatic and schematic in nature; the Contractor is solely responsible for dimensioning and coordinating the Work of the Contract Documents. All field engineering required for laying out the Work and establishing grades for earthwork operations shall be by the Contractor at its expense. Any field engineering or other engineering to be provided or performed by the Contractor under the Contract Documents and required or necessary for the proper execution or installation of the Work shall be provided and performed by the an engineer duly registered under the laws of the State of California in the engineering discipline for such portion of the Work.

4.1.4 Work in Accordance With Contract Documents. The Contractor shall perform all of the Work in strict conformity with the Contract Documents, the Laws and Architect accepted Submittals.

4.2 Site Investigation; Subsurface Conditions.

4.2.1 Contractor Investigation. The Contractor is responsible for, and by executing the Agreement acknowledges, that it has carefully examined the Site and has taken all steps it deems reasonably necessary to ascertain all conditions which may affect the Work, or the cost thereof, including, without limitation, conditions bearing upon transportation, disposal, handling or storage of materials; availability of labor or utilities; access to the Site; and the physical conditions and the character of equipment, materials, labor and services necessary to perform the Work. Any failure of the Contractor to do so will not relieve it from the responsibility for fully and completely performing all Work without adjustment to the Contract Price or the Contract Time. The District assumes no responsibility to the Contractor for any understandings or representations concerning conditions or characteristics of the Site, or the Work, made by any of its officers, employees or agents prior to the execution of the Agreement, unless such understandings or representations are expressly set forth in the Contract Documents.

4.2.2 Subsurface Data. By executing the Agreement, the Contractor acknowledges that it has examined the boring data and other subsurface data available and satisfied itself as to the character, quality and quantity of surface and subsurface materials, including without limitation, obstacles which may be encountered in performance of the Work, insofar as this information is reasonably ascertainable from an inspection of the Site, review of available subsurface data and

analysis of information furnished by the District under the Contract Documents. Subsurface data or other soils investigation report provided by the District hereunder are not a part of the Contract Documents. Information contained in such data or report regarding subsurface conditions, elevations of existing grades or below grade elevations are approximate only and are neither guaranteed or warranted by the District to be complete and accurate. The Contractor shall examine all boring and other subsurface data to make its own independent interpretation of the subsurface conditions and acknowledges that its bid is based upon its own opinion of the conditions which may be encountered. The District assumes no responsibility for any conclusions or interpretations made by Contractor on the basis of available subsurface data or other information furnished by District under the Contract Documents.

4.2.3 Subsurface Conditions. If the Work involves digging trenches or other excavations that extend deeper than four feet below the surface, the Contractor shall promptly and before the following conditions are disturbed, notify the District's Inspector, in writing, of any: (i) material that the Contractor believes may be material that is hazardous waste, as defined in California Health and Safety Code §25117, that is required to be removed to a Class I or Class II or Class III disposal site in accordance with provisions of existing law; (ii) subsurface or latent physical conditions at the site differing from those indicated; or (iii) unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in the Work or the character provided for in the Contract Documents. If upon notice to the District of the conditions described above and upon the District's investigation thereof, the District determines that the conditions so materially differ or involve such hazardous materials which require an adjustment to the Contract Price or the Contract Time, the District shall issue a Change Order in accordance with Article 9 hereof. In accordance with California Public Contract Code §7104, any dispute arising between the Contractor and the District as to any of the conditions listed in (i), (ii) or (iii) above, shall not excuse the Contractor from the completion of the Work within the Contract Time and the Contractor shall proceed with all Work to be performed under the Contract Documents. The District reserves the right to terminate the Contract pursuant to Article 15.2 hereof should the District determine not to proceed because of any condition described in (i), (ii) or (iii) above.

4.3 Supervision and Construction Procedures.

4.3.1 Supervision of the Work. During progress of the work, the Contractor/Superintendent hall be on site to supervise and direct performance of the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract Documents, unless Contract Documents give other specific instructions concerning these matters. The Contractor shall be responsible for inspection of completed or partially completed portions of Work to determine that such portions are in proper condition to receive subsequent Work.

4.3.2 Responsibility for the Work. The Contractor is responsible to the District for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and all other persons performing any portion of the Work under a contract with the Contractor. The Contractor is not relieved from its obligation to perform the Work in accordance with the Contract Documents either by activities or duties of the Project Manager, District's Inspector or the Architect, or by tests, inspections or approvals required or performed by persons other than the Contractor.

4.3.3 Surveys. The Contractor shall prepare or cause to be prepared all detailed surveys necessary for performance of the Work, including without limitation, slope stakes, points, lines and elevations. The Contractor is responsible for the establishment, location, maintenance and preservation of benchmarks, reference points and stakes for the Work without adjustment of the Contract Price. The Contractor is solely responsible for all loss or costs resulting from the loss, destruction, disturbance or damage of benchmarks, reference points or stakes.

4.3.4 Construction Utilities. The District will furnish and pay the costs of utility services for the Work as set forth in the Special Conditions; all other utilities necessary to complete the Work and the Contractor's obligations hereunder shall be obtained by the Contractor without adjustment of the Contract Price or the Contract Time. The Contractor shall furnish and install necessary or appropriate temporary distributions of utilities, including utilities furnished by the District. Any such temporary distributions shall be removed by the Contractor upon completion of the Work. The costs of all such utility services, including the installation, relocations and removal of temporary distributions thereof, shall be borne by the Contractor and included in the Contract Price.

4.3.5 Existing Utilities; Removal, Relocation and Protection. In accordance with California Government Code §4215, the District assumes responsibility for the timely removal, relocation, or protection of existing main or trunkline utility facilities located on the Site which are not identified in the Drawings, Specifications or other Contract Documents. Contractor shall be compensated for the costs of locating, repairing damage not due to the Contractor's failure to exercise reasonable care, and removing or relocating such utility facilities not indicated in the Drawings, Specifications and other Contract Documents with reasonable accuracy and for equipment on the Site necessarily idled during such work. Contractor shall not be assessed Liquidated Damages for delay in completion of the Work when such delay is caused by the failure of the District or the owner of the utility to provide for removal or relocation of such utility facilities. The foregoing notwithstanding, the District is not required to indicate the presence of existing service laterals or appurtenances whenever the presence of such utilities can be inferred from the presence of other visible facilities, such as buildings, meters and junction boxes, on or adjacent to the Site. If the Contractor encounters utility facilities not identified by the District in the Drawings, Specifications, or other Contract Documents, the Contractor shall immediately notify, in writing, the District, the District's inspector, the Architect, the Project Manager and the utility owner. If utility facilities are owned by a public utility, the public utility shall have the sole discretion to perform repairs or relocation work or permit the Contractor to do such repairs or relocation work at a reasonable price.

4.3.6 Conferences and Meetings. A material obligation of the Contractor under the Contract Documents is the attendance by the Contractor's supervisory personnel for the Work and the Contractor's management personnel as required by the Contract Documents or as requested by the District. The Contractor's personnel participating in conferences and meetings relating to the Work shall be authorized to act on behalf of the Contractor and to bind the Contractor. The Contractor is solely responsible for arranging for the attendance by Subcontractors, Material Suppliers at meetings and conferences relating to the Work as necessary, appropriate or as requested by the District.

4.3.6.1 Pre-Construction Conference. The Contractor's representatives (and representatives of Subcontractors as requested by the District) shall attend a Pre-Construction Conference at such time and place as designated by the District. The Pre-Construction Conference will address items such as the Contractor's access to the Site, review of construction procedures and requirements and other matters pertaining generally to construction of the Work.

4.3.6.2 Progress Meetings. Progress meetings will be conducted on regular intervals (weekly unless otherwise expressly indicated elsewhere in the Contract Documents). The Contractor's representatives and representatives of Subcontractors (as requested by the District) shall attend Progress Meetings. Progress Meetings will be chaired by the Architect or the Project Manager and will generally include as agenda items: Site safety, field issues, coordination of Work, construction progress and impacts to timely completion, if any. The purposes of the Progress Meetings include: a formal and regular forum for discussion of the status and progress of the Work by all Project participants, a review of progress or resolution of previously raised issues and action items assigned to

the Project participants, and reviews of the Construction Schedule and Submittals.

4.3.6.3 Special Meetings. As deemed necessary or appropriate by the District, Special Meetings will be conducted with the participation of the Contractor, Subcontractors and other Project participants as requested by the District.

4.3.6.4 Minutes of Meetings. Following conclusion of the Pre-Construction Conference, Progress Meetings and Special Meetings, the Architect or the Project Manager will prepare and distribute minutes reflecting the items addressed and actions taken at a meeting or conference. Unless the Contractor notifies the Architect or the Project Manager in writing of objections or corrections to minutes prepared hereunder within five (5) days of the date of distribution of the minutes, the minutes as distributed shall constitute the official record of the meeting or conference. No objections or corrections of any Subcontractor or Material Supplier shall be submitted directly to the Architect or the Project Manager; such objections or corrections shall be submitted to the Architect and the Project Manager through the Contractor. If the Contractor timely interposes objections or notes corrections, the resolution of such matters shall be addressed at the next scheduled Progress Meeting.

4.4 Labor and Materials.

4.4.1 Payment for Labor, Materials and Services. Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, Construction Equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated in the Work.

4.4.2 Employee Discipline. The Contractor shall enforce strict discipline and good order among the Contractor's employees, the employees of any Subcontractor or Sub-subcontractor, and all other persons performing any part of the Work at the Site. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. The Contractor shall dismiss from its employ and direct any Subcontractor or Sub-subcontractor to dismiss from their employment any person deemed by the District to be unfit or incompetent to perform Work and thereafter, the Contractor shall not employ nor permit the employment of such person for performance of any part of the Work without the prior written consent of the District, which consent may be withheld in the reasonable discretion of the District.

4.4.3 Compliance with Immigration Reform and Control Act of 1986. The Contractor is solely and exclusively responsible for employment of individuals for the Work of the Contract in conformity with the Immigration Reform and Control Act of 1986, 8 USC §§1101 et seq. (the "IRCA"); the Contractor shall also require Subcontractors and any other person or entity employing labor in connection with any of the Work to so similarly comply with the IRCA. The foregoing includes without limitation, verification that individuals engaged in any Work are legally entitled to do so.

4.4.4 Contractor's Supervisory Personnel. Prior to start of Work at the Site, the Contractor shall submit to the District, Architect and Project Manager, a written statement of the qualifications of the Contractor's proposed Superintendent and Project Manager for the Work. Acceptance of the Contractor's proposed Superintendent and Project Manager is subject to establishing their: (i) skills, experience and other capabilities to supervise, coordinate and manage the Work; (ii) fluent verbal and written English language capabilities; (iii) competency in reading, comprehending and understanding drawings, specifications and other technical construction-related materials; and (iv) recent experience of in completing construction projects similar to the Work within the budget and time established for such other construction projects. Upon acceptance of the Contractor's Superintendent or Project Manager by the District, the Contractor shall not be change such personnel without prior consent of the District, unless such personnel: (i) are unsatisfactory to the Contractor and ceases to be employed by the Contractor for the Work; or (ii) is determined by the District to be unfit, incompetent or incapable of

performing functions and responsibilities assigned.

4.4.5 Prohibition on Harassment.

4.4.5.1 District's Policy Prohibiting Harassment. The District is committed to providing a campus and workplace free of sexual harassment and harassment based on factors such as race, color religion, national origin, ancestry, age, medical condition, marital status, disability, veteran status or other legally protected classification. Harassment includes without limitation, verbal, physical or visual conduct which creates an intimidating, offensive or hostile environment such as racial slurs; ethnic jokes; posting of offensive statements, posters or cartoons or similar conduct. Sexual harassment includes without limitation the solicitation of sexual favors, unwelcome sexual advances, or other verbal, visual or physical conduct of a sexual nature.

4.4.5.2 Contractor's Adoption of Anti-Harassment Policy. Contractor shall adopt and implement all appropriate and necessary policies prohibiting any form of discrimination in the workplace, including without limitation harassment on the basis of any classification protected under local, state or federal law, regulation or policy. Contractor shall take all reasonable steps to prevent harassment from occurring, including without limitation affirmatively raising the subject of harassment among its employees, expressing strong disapproval of any form of harassment, developing appropriate sanctions, informing employees of their right to raise and how to raise the issue of harassment and informing complainants of the outcome of an investigation into a harassment claim. Contractor shall require that any Subcontractor or Sub-subcontractor performing any portion of the Work to adopt and implement policies in conformity with this Article 4.4.4.

4.4.5.3 Prohibition on Harassment at the Site. Contractor shall not permit any person, whether employed by Contractor, a Subcontractor, or any other person or entity, performing any Work at or about the Site to engage in any prohibited form of harassment. Any such person engaging in a prohibited form of harassment directed to any individual performing or providing any portion of the Work at or about the Site shall be subject to appropriate sanctions in accordance with the anti-harassment policy adopted and implemented pursuant to Article 4.4.4.2 above. Any person, performing or providing Work on or about the Site engaging in a prohibited form of harassment directed to any student, faculty member or staff of the District or directed to any other person on or about the Site shall be subject to immediate removal and shall be prohibited thereafter from providing or performing any portion of the Work. Upon the District's receipt of any notice or complaint that any person employed directly or indirectly by Contractor in performing or providing the Work has engaged in a prohibited form of harassment, the District will promptly undertake an investigation of such notice or complaint. If the District, after such investigation, reasonably determines that a prohibited form of harassment has occurred, the District shall promptly notify the Contractor of the same and direct that the person engaging in such conduct be immediately removed from the Site. Unless the District's determination that a prohibited form of harassment has occurred is grossly negligent or without reasonable cause, District shall have no liability for directing the removal of any person determined to have engaged in a prohibited form of harassment nor shall the Contract Price or the Contract Time be adjusted on account thereof. Contractor and the Surety shall defend, indemnify and hold harmless the District and its employees, officers, board of trustees, agents, and representatives from any and all claims, liabilities, judgments, awards, actions or causes of actions, including without limitation, attorneys' fees, which arise out of, or pertain in any manner to: (i) the assertion by any person dismissed from performing or providing work at the direction of the District pursuant to this Article 4.4.4.3; or (ii) the assertion by any person that any person directly or indirectly under the employment or direction of the Contractor has engaged in a prohibited form of harassment directed to or affecting such person. The obligations of the Contractor and

the Surety under the preceding sentence are in addition to, and not in lieu of, any other obligation of defense, indemnity and hold harmless whether arising under the Contract Documents, at law or otherwise; these obligations survive completion of the Work or the termination of the Contract.

4.5 Taxes. The Contractor shall pay, without adjustment of the Contract Price, all sales, consumer, use and other taxes for the Work or portions thereof provided by the Contractor under the Contract Documents.

4.6 Permits, Fees and Notices; Compliance With Laws.

4.6.1 Payment of Permits, Fees. Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permits, other permits, governmental fees, licenses and inspections necessary or required for the proper execution and completion of the Work.

4.6.2 Compliance With Laws. The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and other orders of public authorities bearing on performance of the Work.

4.6.3 Notice of Variation From Laws. If the Contractor knows, or has reason to believe, that any portion of the Contract Documents are at variance with applicable laws, statutes, ordinances, building codes, regulations or rules, the Contractor shall promptly notify the Architect and the District's Inspector, in writing, of the same. If the Contractor performs Work knowing, or with reasonable diligence should have known, it to be contrary to laws, statutes, ordinances, building codes, rules or regulations applicable to the Work without such notice to the Architect and the District's Inspector, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs arising or associated therefrom, including without limitation, the removal, replacement or correction of the same.

4.7 Submittals.

4.7.1 Purpose of Submittals. Submittals are not Contract Documents. Submittals are for the purpose of demonstrating, for those portions of the Work for which Submittals are required, the manner in which the Contractor proposes to provide or incorporate such item of the Work in conformity with the information given and the design concept expressed in the Contract Documents.

4.7.2 Contractor's Submittals.

4.7.2.1 Prompt Submittals. The Contractor shall review, approve and submit to the Architect or such other person or entity designated by the District or the Contract Documents, the number of copies of Submittals required by the Contract Documents. All Submittals required by the Contract Documents shall be prepared, assembled and submitted by the Contractor within the time frames set forth in the Submittal Schedule incorporated and made a part of the Approved Construction Schedule. Contractor's submission of Submittals in conformity with the Submittal Schedule is a material obligation of the Contractor. If the Contractor fails or refuses to deliver Submittals in accordance with the Submittal Schedule, the Contractor shall be subject to per diem assessments in the amount set forth in the Special Conditions for each day of delayed submission for any Submittal beyond the date set forth in the Submittal Schedule for Contractor's submission of such Submittal. Contractor and the District acknowledge and agree that the per diem assessment for delayed submission of Submittals set forth in the Special Conditions represents a reasonable estimate of costs and expenses the District will incur as a result of delayed submission of Submittals and that the same is not a penalty. Notwithstanding Contractor's submission of all required Submittals in accordance with the Submittal Schedule, in the event that the District or the Architect reasonably determines that all or any portion of such Submittals fail to comply with the requirements of Articles 4.7.2.2, 4.7.2.3 and 4.7.2.4 of these General Conditions and/or

such Submittals are not otherwise complete and accurate so as to require re-submission, Contractor shall bear all costs associated with the review and approval of resubmitted Submittals, including without limitation Architect's fees incurred in connection therewith; provided that such costs are in addition to, and not in lieu of, Liquidated Damages imposed under this Article 4.7.2.1 for Contractor's delayed submission of Submittals. If Liquidated Damages are assessed for the Contractor's delayed submission of Submittals or if the Contractor is assessed Architect fees to review incomplete or inaccurate Submittals, the District may deduct the same from any portion the Contract Price then or thereafter due the Contractor. Submittals not required by the Contract Documents or which do not otherwise conform to the requirements of the Contract Documents may be returned without action. No adjustment to the Contract Time or the Contract Price shall be granted to the Contractor on account of its failure to timely submit of any Submittal.

4.7.2.2 Approval of Subcontractor Submittals. All Submittals prepared by Subcontractors, Material Suppliers, manufacturers or distributors shall bear the written approval of the Contractor thereto prior to submission to the Architect for review. Any Submittal not bearing the Contractor's written approval shall be subject to return to the Contractor for re-submittal in conformity herewith, with the same being deemed to not have been submitted. Any delay, impact or cost associated therewith shall be the sole and exclusive responsibility of the Contractor without adjustment to the Contract Time or the Contract Price.

4.7.2.3 Verification of Submittal Information. By approving and submission of Submittals, the Contractor represents to the District and Architect that the Contractor has determined and verified materials, field measurements, field construction criteria, catalog numbers and similar data related thereto and has checked and coordinated the information contained within such Submittals with the requirements of the Work and of the Contract Documents.

4.7.2.4 Information Included in Submittals. All Submittals shall be accompanied by a written transmittal or other writing by the Contractor providing an identification of the portion of the Drawings or the Specifications pertaining to the Submittal, with each Submittal numbered consecutively for ease of reference along with the following information: (i) date of submission; (ii) project name; (iii) name of submitting Subcontractor; and (iv) if applicable, the revision number. The foregoing information is in addition to, and not in lieu of, any other information required by the Contract Documents for the Architect's review, evaluation and acceptance of the Contractor's Submittals.

4.7.2.5 Contractor Responsibility for Deviations. The Contractor shall not be relieved of responsibility for correcting deviations from the requirements of the Contract Documents by the Architect's review of Submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submission of the Submittal and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Submittals by the Architect's review thereof.

4.7.2.6 No Performance of Work Without Architect Review. The Contractor shall perform no portion of the Work requiring the Architect's review of Submittals until the Architect has completed its review and returned the Submittal to the Contractor indicating "No Exception Taken" to such Submittal. The Contractor shall not perform any portion of the Work forming a part of a Submittal or which is affected by a related Submittal until the entirety of the Submittal or other related Submittal has been fully processed. Such Work shall be in accordance with the final action taken by the Architect in review of Submittals and other applicable portions of the Contract Documents.

4.7.3 Architect Review of Submittals. The purpose of the Architect's review of Submittals and the time for the Architect's return of Submittals to the Contractor shall be as set forth elsewhere

Notation	Action Required
No Exceptions Taken	No formal revision required
Make Corrections Noted	Make revision noted; re-submission of revised Submittal not required
Revise and Re-Submit	Revise Submittal in accordance with notations and re-submit for revision
Rejected Re-Submit	Prepare new alternative Submittal and re-submit for review

in the Contract Documents. If the Architect returns a Submittal as rejected or requiring correction(s) with re-submission, the Contractor, so as not to delay the progress of the Work, shall promptly thereafter resubmit a Submittal conforming to the requirements of the Contract Documents; the resubmitted Submittal shall indicate the portions thereof modified in accordance with the Architect's direction. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon the accuracy and completeness of such calculations and certifications accompanying Submittals. The Architect's review of the Submittals is for the limited purposes described in the Contract Documents. The following notations or notations of a similar nature noted on a reviewed Submittal will require the Contractor action noted below.

4.7.4 Deferred Approval Items. If any portion of the Work is designated in the Contract Documents as a "Deferred Approval" item, Contractor shall be solely and exclusively responsible for: (i) the design, engineering and specifying the materials/equipment forming any part of the Deferred Approval Item; (ii) integrating and/or coordinating the Deferred Approval Item with other portions of the Work; (iii) preparation of Submittals for such item(s) in a timely manner so as not to delay or hinder the completion of the Work within the Contract Time; and (iv) timely obtaining DSA approval thereof.

4.8 Materials and Equipment.

4.8.1 Specified Materials, Equipment. References in the Contract Documents to any specific article, device, equipment, product, material, fixture, patented process, form, method or type of construction, by name, make, trade name, or catalog number, with or without the words "or equal" shall be deemed to establish a minimum standard of quality or performance, and shall not be construed as limiting competition.

4.8.2 Approval of Substitutions or Alternatives. The Contractor may propose to furnish alternatives or substitutes for a particular item specified in the Contract Documents, provided that: (i) such proposed substitution or alternative complies with the requirements of the Specifications relating to substitutions of specified items; (ii) the Contractor certifies to the Architect and District that the quality, performance capability and functionality (including visual and/or aesthetic effect) of the proposed alternative or substitute meet or exceed the quality, performance capability and functionality of the item or process specified; and (iii) demonstrate to the reasonable satisfaction of the Architect and District that the use of the substitution or alternative is appropriate and will not delay completion of the Work or result in an increase to the Contract Price. The Contractor shall submit calculations engineering, construction, dimension, visual, aesthetic and performance data to the Architect to permit its proper evaluation of the proposed substitution or alternative. If requested by the Architect, Contractor shall promptly furnish any additional information or data regarding a proposed substitution or alternative which the Architect deems reasonably necessary for the evaluation of the proposed substitution or alternative. The Contractor shall not provide, furnish or install any substitution or alternative without the Architect's review and final action on the proposed substitution or alternative; any alternative or substitution installed or incorporated into the Work without first

obtaining the Architect's review and final action of the same shall be subject to removal pursuant to Article 12 hereof. The Architect's decision evaluating the Contractor's proposed substitutions or alternatives shall be final. Neither the Contract Time nor the Contract Price shall be increased on account of any substitution or alternative proposed by the Contractor and which is accepted by the Architect; provided, however, that in the event a substitution or alternative accepted by the Architect and purchase, fabrication and/or installation or such accepted substitution or alternative shall be less expensive than the originally specified item, the Contract Price shall be reduced by the actual cost savings realized by the Contractor's furnishing and/or installation of such approved substitution or alternative. The Contractor shall be solely responsible for all costs and fees incurred by the District to review a proposed substitution or alternative, including without limitation fees of the Architect, and/or governmental agencies to review and/or approve any proposed substitution or alternative. The Contractor shall be solely responsible for any increase in the cost of any accepted substitution or alternative or any Work affected by such alternative or substitution. The foregoing notwithstanding, all requests for the Architect's review and approval of any proposed substitution or alternative and all engineering, construction, dimension and performance data substantiating the equivalency of the proposed substitution or alternative shall be submitted by Contractor not later than thirty-five (35) days following the date of the District's award of the Contract to Contractor by action of the District's Board of Trustees; any request for approval of proposed alternatives or substitutions submitted thereafter may be rejected summarily. The foregoing process and time limits shall apply to any proposed substitution or alternative regardless of whether the substitute or alternate item is to be provided, furnished or installed by Contractor, any Subcontractor, any Sub-Subcontractor, Material Supplier or Manufacturer.

4.8.3 Placement of Material and Equipment Orders. Contractor shall, after award of the Contract, promptly and timely place all orders for materials and/or equipment necessary for completion of the Work so that delivery of the same shall be made without delay or interruption to the timely completion of the Work. Contractor shall require that any Subcontractor similarly place orders for all materials and/or equipment to be furnished by any such Subcontractor in a prompt and timely manner so that delivery of the same shall be made without delay or interruption to the timely completion of the Work. Upon request of the District, Project Manager or the Architect, the Contractor shall furnish reasonably satisfactory written evidence of the placement of orders for materials and/or equipment necessary for completion of the Work, including without limitation, orders for materials and/or equipment to be provided, furnished or installed by any Subcontractor.

4.8.4 District's Right to Place Orders for Materials and/or Equipment. Notwithstanding any other provision of the Contract Documents, if the Contractor shall, upon request of the District, Project Manager or the Architect, fails or refuses, for any reason, to provide reasonably satisfactory written evidence of the placement of orders for materials and/or equipment necessary for completion of the Work, or should the District determine, in its sole and reasonable discretion, that any orders for materials and/or equipment have not been placed in a manner so that such materials and/or equipment will be delivered to the Site so the Work can be completed without delay or interruption, the District shall have the right, but not the obligation, to place such orders on behalf of the Contractor. If the District exercises the right to place orders for materials and/or equipment pursuant to the foregoing, the District's conduct shall not be deemed to be an exercise, by the District, of any control over the means, methods, techniques, sequences or procedures for completion of the Work, all of which remain the responsibility and obligation of the Contractor. Notwithstanding the right of the District to place orders for materials and/or equipment pursuant to the foregoing, the election of the District to exercise, or not to exercise, such right shall not relieve the Contractor from any of Contractor's obligations under the Contract Documents, including without limitation, completion of the Work within the Contract Time and for the Contract Price. If the District exercises the right hereunder to place orders for materials and/or equipment on behalf of Contractor pursuant to the foregoing, Contractor shall reimburse

the District for all costs and fees incurred by the District in placing such orders; such costs and fees may be deducted by the District from the Contract Price then or thereafter due the Contractor.

4.8.5 Contractor and Subcontractor Communication. All written communications between the Contractor and any Subcontractor, Material Supplier or others directly or indirectly engaged by the Contractor to perform or provide any portion of the Work shall be available to the District, the Project Manager and the Architect for review, inspection and reproduction as may be requested from time to time. The foregoing is a material obligation of the Contractor hereunder.

4.9 Safety.

4.9.1 Safety Programs. The Contractor shall be solely responsible for initiating, maintaining and supervising all safety programs required by applicable law, ordinance, regulation or governmental orders in connection with the performance of the Contract, or otherwise required by the type or nature of the Work. The Contractor's safety program shall include all actions and programs necessary for compliance with California or federally statutorily mandated workplace safety programs, including without limitation, compliance with the California Drug Free Workplace Act of 1990 (California Government Code §§8350 et seq.). Without limiting or relieving the Contractor of its obligations hereunder, the Contractor shall require that its Subcontractors similarly initiate and maintain all appropriate or required safety programs.

4.9.2 Contractor Safety Plan. Prior to commencement of Work at the Site, the Contractor shall submit to the District and the Project Manager, if any, the Contractor's Safety Plan for the Work for review and acceptance by the District. Acceptance by the District is subject to the Safety Plan conforming to requirements of the Laws, conditions at or about the Site and the nature of the Work. The Contractor shall modify its Safety Plan as necessary to obtain the District's acceptance thereof. Notwithstanding the District's acceptance of the Contractor's Safety Plan, the Contractor shall remain solely responsible for implementing the Safety Plan and implementing measures as necessary to maintain safety of persons and property at and about the Site. The District's acceptance of the Contractor's Safety Plan shall not limit, restrict or otherwise modify the Contractor's obligations relating to safety at or about the Site in accordance with the Contract Documents and the Laws.

4.9.3 Safety Precautions. The Contractor shall be solely responsible for initiating and maintaining reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to: (i) employees on the Work and other persons who may be affected thereby; (ii) the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site, under care, custody or control of the Contractor or Subcontractors; and (iii) other property or items at the Site, or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement.

4.9.4 Safety Signs, Barricades. The Contractor shall erect and maintain, as required by existing conditions and conditions resulting from performance of the Contract, reasonable safeguards for safety and protection of property and persons, including, without limitation, posting danger signs and other warnings against hazards, barricades, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

4.9.5 Safety Notices. The Contractor shall give or post all safety notices required by the Laws and comply with the Laws bearing on safety of persons or property or their protection from damage, injury or loss.

4.9.6 Safety Coordinator. The Contractor shall designate a responsible member of the Contractor's organization at the Site whose duty shall be the prevention of accidents and the implementation and maintenance safety precautions and programs. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Project Manager, District's Inspector and the Architect.

4.9.7 Emergencies. In an emergency affecting safety of persons or property, the Contractor

shall act, to prevent threatened damage, injury or loss.

4.9.8 Hazardous Materials.

4.9.8.1 General. If the Contractor, any Subcontractor or anyone employed directly or indirectly by them shall use, at the Site, or incorporate into the Work, any material or substance deemed to be hazardous or toxic under any law, rule, ordinance, regulation or interpretation thereof (collectively "Hazardous Materials"), the Contractor shall comply with all Laws applicable thereto and shall exercise all necessary safety precautions relating to the use, storage or disposal thereof.

4.9.8.2 Prohibition on Use of Asbestos Construction Building Materials ("ACBMs"). Notwithstanding any provision of the Drawings or the Specifications to the contrary, it is the intent of the District that ACBMs not be used or incorporated into any portion of the Work. In the event that any portion of the Work depicted in the Drawings or the Specifications shall require materials or products which the Contractor knows, or should have known with reasonably diligent investigation, to contain ACBMs, Contractor shall promptly notify the Architect and the District's Inspector of the same so that an appropriate alternative can be made in a timely manner so as not to delay the progress of the Work. Contractor warrants to the District that there are no materials or products used or incorporated into the Work which contain ACBMs. Whether before or after completion of the Work, if it is discovered that any product or material forming a part of the Work or incorporated into the Work contains ACBMs, the Contractor shall at its sole cost and expense remove such product or material in accordance with any laws, rules, procedures and regulations applicable to the handling, removal and disposal of ACBMs and to replace such product or material with non-ACBM products or materials and to return the affected portion(s) of the Work to the finish condition depicted in the Drawings and Specifications relating to such portion(s) of the Work. Contractor's obligations under the preceding sentence shall survive the termination of the Contract, the warranty period provided under the Contract Documents, the Contractor's completion of the Work or the District's acceptance of the Work. If the Contractor fails or refuses, for any reason, to commence the removal and replacement of any material or product containing ACBMs forming a part of, or incorporated into the Work, within ten (10) days of the date of the District's written notice to the Contractor of the existence of ACBM materials or products in the Work, the District may thereafter proceed to cause the removal and replacement of such materials or products in any manner which the District determines to be reasonably necessary and appropriate; all costs, expenses and fees, including without limitation fees and costs of consultants and attorneys, incurred by the District in connection with such removal and replacement shall be the responsibility of the Contractor and the Surety.

4.9.8.3 Disposal of Hazardous Materials. Contractor shall be solely and exclusively responsible for the disposal of any Hazardous Materials on or about the Site. The Contractor's obligations hereunder shall include without limitation, the transportation and disposal of any Hazardous Materials in strict conformity with the Laws.

4.10 Maintenance of Documents.

4.10.1.1 Documents at Site. The Contractor shall maintain at the Site: (i) one record copy of the Drawings, Specifications and all addenda thereto; (ii) Change Orders approved by the District and all other modifications to the Contract Documents; (iii) Submittals reviewed by the Architect; (iv) Record Drawings; (v) Material Safety Data Sheets ("MSDS") accompanying any materials, equipment or products delivered or stored at the Site or incorporated into the Work; and (vi) all building and other codes or regulations applicable to the Work, including without limitation, Title 24, Part 2 of the California Code of Regulations. During performance of the Work, all documents maintained by Contractor at the Site shall be available to the District, the Project

Manager, the Architect, the District's Inspector and DSA for review, inspection or reproduction. Upon completion of the Work, all documents maintained at the Site by the Contractor pursuant to the foregoing shall be assembled and transmitted to the Architect for delivery to the District.

4.10.1.2 Maintenance of Record Drawings. During its performance of the Work, the Contractor shall maintain Record Drawings consisting of a set of the Drawings which are marked to indicate all field changes made to adapt the Work depicted in the Drawings to field conditions, changes resulting from Change Orders and all concealed or buried installations, including without limitation, piping, conduit and utility services. All buried or concealed items of Work shall be completely and accurately marked and located on the Record Drawings. The Record Drawings shall be clean and all changes, corrections and dimensions shall be marked in a neat and legible manner in a contrasting color. Record Drawings relating to the Structural, Mechanical, Electrical and Plumbing portions of the Work shall indicate without limitation, circuiting, wiring sizes, equipment/member sizing and shall depict the entirety of the as built conditions of such portions of the Work. The Record Drawings shall be continuously maintained by the Contractor during the performance of the Work. At any time during the Contractor's performance of the Work, upon the request of the District, the District's Inspector or the Architect, the Contractor shall make the Record Drawings maintained here under available for the District's review and inspection. The District's review and inspection of the Record Drawings during the Contractor's performance of the Work shall be only for the purpose of generally verifying that Contractor is continuously maintaining the Record Drawings in a complete and accurate manner; any such inspection or review shall not be deemed to be the District's approval or verification of the completeness or accuracy thereof. The failure or refusal of the Contractor to continuously maintain complete and accurate Record Drawings or to make available the Record Drawings for inspection and review by the District may be deemed by the District to be Contractor's default of a material obligation hereunder. Without waiving, restricting or limiting any other right or remedy of the District for the Contractor's failure or refusal to continuously maintain the Record Drawings, the District may, upon reasonably determining that the Contractor has not, or is not, continuously maintaining the Record Drawings in a complete and accurate manner, take appropriate action to cause the continuous maintenance of complete and accurate Record Drawings, in which event all fees and costs incurred or associated with such action shall be charged to the Contractor and the District may deduct the amount of such fees and costs from any portion of the Contract Price then or thereafter due the Contractor. In accordance with Article 8.4.2 of these General Conditions, prior to receipt of the Final Payment, Contractor shall deliver the Record Drawings to the Architect.

4.11 Use of Site. The Contractor shall confine operations at the Site to areas permitted by the Laws, subject to any restrictions or limitations set forth in the Contract Documents. The Contractor shall not unreasonably encumber the Site or adjoining areas with materials or equipment. The Contractor shall be solely responsible for providing security at the Site with all such costs included in the Contract Price. The District shall at all times have access to the Site.

4.12 Clean-Up. The Contractor shall at all times keep the Site and all adjoining areas free from the accumulation of any waste material or rubbish caused or generated by performance of the Work. Without limiting the generality of the foregoing, Contractor shall maintain the Site in a "rake-clean" standard on a daily basis. If the Work includes painting and/or the installation of floor covering, before any painting operations or the installation of any flooring covering, the area and adjoining areas of the Site where paint is to be applied or floor covering is to be installed shall be in a "broom-clean" condition. Prior to completion of the Work, Contractor shall remove from the Site all rubbish, waste materials, excess excavated materials, tools, Construction Equipment, machinery, surplus materials and any other items which are not the property of the District under the Contract

Documents. Upon completion of the Work, the Site and all adjoining areas shall be left by the Contractor in a neat and broom clean condition satisfactory to District. The District's Inspector or Project Manager shall be authorized to direct the Contractor's clean-up obligations hereunder. If the Contractor fails to clean up as provided for in the Contract Documents, the District may do so, and all costs incurred in connection therewith shall be charged to the Contractor; the District may deduct such costs from any portion of the Contract Price then or thereafter due the Contractor.

4.13 Access to the Work. The Contractor shall provide DSA, the District, the Project Manager, the District's Inspector and the Architect access to the Work, whether in place, preparation and progress and wherever located.

4.14 Facilities and Information for the District's Inspector.

4.14.1 Information to District's Inspector. The Contractor shall furnish the District's Inspector access to the Work for obtaining such information as may be necessary to keep the District's Inspector fully informed respecting the progress, quality and character of the Work and materials, equipment or other items incorporated therein.

4.14.2 Facilities for District's Inspector. Facilities, services or other items to be provided by the Contractor for use by the District's Inspector, if any, shall be as set forth in the Temporary Facilities and Controls Specification Section. If the Contractor fails or refuses to provide and such facilities, services or other items designated the District may furnish such facilities, services or other item, with the costs, fees or expenses incurred to furnish the same being deducted from the Contract Price.

4.15 Patents and Royalties. The Contractor and the Surety shall defend, indemnify and hold harmless the District and its agents, employees and officers from any claim, demand or legal proceeding arising out of or pertaining, in any manner, to any actual or claimed infringement of patent rights in connection with performance of the Work.

4.16 Cutting and Patching. The Contractor is responsible for cutting, fitting or patching required to complete the Work or to make the component parts thereof fit together properly. The Contractor shall not damage or endanger any portion of the Work, or the fully or partially completed construction of the District or separate contractors by cutting, patching, excavation or other alteration. The Contractor shall not cut, patch or otherwise alter the construction by the District or separate contractor without the prior written consent of the District or separate contractor thereto, which consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold consent to the request of the District or separate contractor to cut, patch or otherwise alter the Work.

4.17 Encountering of Hazardous Materials. If the Contractor encounters Hazardous Materials at the Site which have not been rendered harmless or for which there is no provision in the Contract Documents for containment, removal, abatement or handling of such Hazardous Materials, the Contractor shall immediately stop the Work in the affected area, but shall diligently proceed with the Work in all other unaffected areas. Upon encountering such Hazardous Materials, the Contractor shall immediately notify the District's Inspector and the Architect, in writing, of such condition. The Contractor shall proceed with the Work in such affected area only after such Hazardous Materials have been rendered harmless, contained, removed or abated. If such Hazardous Materials are encountered, the Contractor shall be entitled to an adjustment of the Contract Time to the extent that the Work is stopped and Completion of the Work is affected thereby. In no event shall there be an adjustment to the Contract Price solely on account of the Contractor encountering such Hazardous Materials.

4.18 Wage Rates; Employment of Labor.

4.18.1 Determination of Prevailing Rates. Pursuant to the provisions of Division 2, Part 7, Chapter 1, Article 2 of the California Labor Code at §§1770 et seq., the District has obtained from the Director of the Department of Industrial Relations the general prevailing rate of per diem wages and the prevailing rate for holiday and overtime work in the locality in which the Work is to be performed. Holidays shall be as defined in the collective bargaining agreement applicable

to each particular craft, classification or type of worker employed under the Contract. Per diem wages include employer payments for health and welfare, pensions, vacation, travel time and subsistence pay as provided in California Labor Code §1773.8, apprenticeship or other training programs authorized by California Labor Code §3093, and similar purposes when the term "per diem wages" is used herein. Holiday and overtime work, when permitted by law, shall be paid for at the rate of at least one and one-half (1½) times the above specified rate of per diem wages, unless otherwise specified. The Contractor shall post, at appropriate and conspicuous locations on the Site, a schedule showing all determined general prevailing wage rates.

4.18.2 Payment of Prevailing Rates. There shall be paid each worker of the engaged in the Work, not less than the general prevailing wage rate for the classification of Work performed, regardless of any contractual relationship which may be alleged to exist between the Contractor or any Subcontractor and such worker.

4.18.3 Prevailing Rate Penalty. The Contractor shall, as a penalty, forfeit not more than Two Hundred Dollars ($200.00) to the District for each calendar day or portion thereof, for each worker paid less than the prevailing rates for such work or craft in which such worker is employed for the Work by the Contractor or by any Subcontractor, of any tier, in connection with the Work. The amount of the penalty for failure to pay applicable prevailing wage rates shall be determined and assessed in accordance with the standards established pursuant to Labor Code §1775(a)(2). The amount of the penalty shall be determined based on consideration of both of the following: (i) whether the failure of the Contractor or Subcontractor to pay the correct rate of per diem wages was a good faith mistake and, if so, the error was promptly and voluntarily corrected when brought to the attention of the Contractor or Subcontractor; and (ii) whether the Contractor or Subcontractor has a prior record of failing to meet its prevailing wage obligations. The penalty may not be less than forty dollars ($40) for each calendar day, or portion thereof, for each worker paid less than the prevailing wage rate, unless the failure of the Contractor or Subcontractor to pay the correct rate of per diem wages was a good faith mistake and, if so, the error was promptly and voluntarily corrected when brought to the attention of the contractor or subcontractor. The penalty may not be less than eighty dollars ($80) for each calendar day, or portion thereof, for each worker paid less than the prevailing wage rate, if the Contractor or Subcontractor has been assessed penalties within the previous three years for failing to meet its prevailing wage obligations on a separate contract, unless those penalties were subsequently withdrawn or overturned. The penalty may not be less than one hundred twenty dollars ($120) for each calendar day, or portion thereof, for each worker paid less than the prevailing wage rate, if the Labor Commissioner determines that the violation was willful, as defined in subdivision (c) of Section 1777.1. When the penalty amount due hereunder is collected from the Contractor or Subcontractor, any outstanding wage claim under Chapter 1 (commencing with Section 1720) of Part 7 of Division 2 against that Contractor or Subcontractor shall be satisfied before applying that amount to the penalty imposed on that Contractor or Subcontractor hereunder. The difference between prevailing wage rates and the amount paid to each worker each calendar day, or portion thereof, for which each worker paid less than the prevailing wage rate, shall be paid to each worker by the Contractor.

4.18.4 Certified Payroll Records.

4.18.4.1 Maintenance of Certified Payroll Records. Pursuant to California Labor Code §1776, the Contractor and each Subcontractor, of any tier, shall keep an accurate payroll record, showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each person employed for the Work.

4.18.4.2 Submittal of Certified Payroll Records to Labor Commissioner. The Contractor and each Subcontractor shall submit their respective Certified Payroll Records to the Labor Commissioner on forms, in the manner and within the times prescribed by the Labor Commissioner.

4.18.4.3 Inspection of Certified Payroll Records. The Certified Payroll Records of

the Contractor and Subcontractors shall be available for inspection at all reasonable hours at the principal office of the Contractor on the following basis: (i) a certified copy of an employee's payroll record shall be made available for inspection or furnished to such employee or his/her authorized representative on request; (ii) a certified copy of all payroll records shall be made available for inspection or furnished upon request to the District, the Division of Labor Standards Enforcement and the Division of Apprenticeship Standards of the Department of Industrial Relations; (iii) a certified copy of payroll records shall be made available upon request to the public for inspection or copies thereof made; provided, however, that a request by the public shall be made through either the District, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement. If the requested Certified Payroll Records have not been provided, the requesting party shall, prior to being provided the records, reimburse the cost of preparation by the Contractor, Subcontractors and the entity through which the request was made; the public shall not be given access to such records at the principal office of the Contractor; (iv) the Contractor shall file a certified copy of the Certified Payroll Records with the entity that requested such records within ten (10) days after receipt of a written request; (v) any copy of records made available for inspection as copies and furnished upon request to the public or any public agency by the District, the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement shall be marked or obliterated in such a manner as to prevent disclosure of an individual's name, address and social security number. The name and address of the Contractor or any Subcontractor, of any tier, performing a part of the Work shall not be marked or obliterated. The Contractor shall inform the District of the location of Certified Payroll Records, including the street address, city and county and shall, within five (5) working days, provide a notice of a change or location and address. In the event of noncompliance with the requirements of this Article 4.18.4, the Contractor shall have ten (10) days in which to comply, subsequent to receipt of written notice specifying in what respects the Contractor must comply herewith. Should noncompliance still be evident after such 10-day period, the Contractor shall, as a penalty to the District, forfeit One Hundred Dollars ($100.00) for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement, such penalties shall be withheld from any portion of the Contract Price then or thereafter due the Contractor. The Contractor is solely responsible for compliance with the foregoing provisions.

4.18.5 Hours of Work.

4.18.5.1 Limits on Hours of Work. Pursuant to California Labor Code §1810, eight (8) hours of labor shall constitute a legal day's work. Pursuant to California Labor Code §1811, the time of service of any worker employed at any time by the Contractor or by a Subcontractor, of any tier, upon the Work or upon any part of the Work, is limited and restricted to eight (8) hours during any one calendar day and forty (40) hours during any one calendar week, except as hereafter provided. Notwithstanding the foregoing provisions, Work performed by employees of Contractor or any Subcontractor, of any tier, in excess of eight (8) hours per day and forty (40) hours during any one week, shall be permitted upon compensation for all hours worked in excess of eight (8) hours per day at not less than one and one-half (12) times the basic rate of pay.

4.18.5.2 Penalty for Excess Hours. The Contractor shall pay to the District a penalty of Twenty-five Dollars ($25.00) for each worker employed on the Work by the Contractor or any Subcontractor, of any tier, for each calendar day during which such worker is required or permitted to work more than eight (8) hours in any calendar day and forty (40) hours in any one calendar week, in violation of the provisions of the California Labor Code, unless compensation to the worker so employed by the Contractor is not less than one and one-half (12) times the basic rate of pay for all hours

worked in excess of eight (8) hours per day.

4.18.5.3 Contractor Responsibility. Any Work performed by workers necessary to be performed after regular working hours or on Sundays or other holidays shall be performed without adjustment to the Contract Price or any other additional expense to the District.

4.18.6 Apprentices.

4.18.6.1 Employment of Apprentices. Any apprentices employed to perform any of the Work shall be paid the standard wage paid to apprentices under the regulations of the craft or trade for which such apprentice is employed, and such individual shall be employed only for the work of the craft or trade to which such individual is registered. Only apprentices, as defined in California Labor Code §3077 who are in training under apprenticeship standards and written apprenticeship agreements under California Labor Code §§3070 et seq. are eligible to be employed for the Work. The employment and training of each apprentice shall be in accordance with the provisions of the apprenticeship standards and apprentice agreements under which such apprentice is training.

4.18.6.2 Apprenticeship Certificate. When the Contractor or any Subcontractor, of any tier, in performing any of the Work employs workers in any Apprenticeable Craft or Trade, the Contractor and such Subcontractor shall apply to the Joint Apprenticeship Committee administering the apprenticeship standards of the craft or trade in the area of the site of the Work for a certificate approving the Contractor or such Subcontractor under the apprenticeship standards for the employment and training of apprentices in the area or industry affected, provided, however, that the approval as established by the Joint Apprenticeship Committee or Committees shall be subject to the approval of the Administrator of Apprenticeship. The Joint Apprenticeship Committee or Committees, subsequent to approving the Contractor or Subcontractor, shall arrange for the dispatch of apprentices to the Contractor or such Subcontractor in order to comply with California Labor Code §1777.5. The Contractor and Subcontractors shall submit contract award information to the applicable Joint Apprenticeship Committee which shall include an estimate of journeyman hours to be performed under the Contract, the number of apprentices to be employed, and the approximate dates the apprentices will be employed. There shall be an affirmative duty upon the Joint Apprenticeship Committee or Committees, administering the apprenticeship standards of the crafts or trades in the area of the site of the Work, to ensure equal employment and affirmative action and apprenticeship for women and minorities. Contractors or Subcontractors shall not be required to submit individual applications for approval to local Joint Apprenticeship Committees provided they are already covered by the local apprenticeship standards.

4.18.6.3 Ratio of Apprentices to Journeymen. The ratio of Work performed by apprentices to journeymen, who shall be employed in the Work, may be the ratio stipulated in the apprenticeship standards under which the Joint Apprenticeship Committee operates, but in no case shall the ratio be less than one hour of apprentice work for each five hours of labor performed by a journeyman, except as otherwise provided in California Labor Code §1777.5. The minimum ratio for the land surveyor classification shall not be less than one apprentice for each five journeymen. Any ratio shall apply during any day or portion of a day when any journeyman, or the higher standard stipulated by the Joint Apprenticeship Committee, is employed at the site of the Work and shall be computed on the basis of the hours worked during the day by journeymen so employed, except for the land surveyor classification. The Contractor shall employ apprentices for the number of hours computed as above before the completion of the Work. The Contractor shall, however, endeavor, to the greatest extent possible, to employ apprentices during the same time period that the journeymen in the same craft or trade are employed at the site of the Work. Where an hourly apprenticeship

ratio is not feasible for a particular craft or trade, the Division of Apprenticeship Standards, upon application of a Joint Apprenticeship Committee, may order a minimum ratio of not less than one apprentice for each five journeymen in a craft or trade classification. The Contractor or any Subcontractor covered by this Article and California Labor Code §1777.5, upon the issuance of the approval certificate, or if it has been previously approved in such craft or trade, shall employ the number of apprentices or the ratio of apprentices to journeymen stipulated in the apprenticeship standards. Upon proper showing by the Contractor that it employs apprentices in such craft or trade in the State of California on all of its contracts on an annual average of not less than one apprentice to each five journeymen, the Division of Apprenticeship Standards may grant a certificate exempting the Contractor from the 1-to-5 ratio as set forth in this Article and California Labor Code §1777.5. This Article shall not apply to contracts of general contractors, or to contracts of specialty contractors not bidding for work through a general or prime contractor, involving less than Thirty Thousand Dollars ($30,000.00) or twenty (20) working days. The term "Apprenticeable Craft or Trade," as used herein shall mean a craft or trade determined as an Apprenticeable occupation in accordance with rules and regulations prescribed by the Apprenticeship Council.

4.18.6.4 Exemption From Ratios. The Joint Apprenticeship Committee shall have the discretion to grant a certificate, which shall be subject to the approval of the Administrator of Apprenticeship, exempting the Contractor from the 1-to-5 ratio set forth in this Article when it finds that any one of the following conditions are met: (i) unemployment for the previous three-month period in such area exceeds an average of fifteen percent (15%) or; (ii) the number of apprentices in training in such area exceeds a ratio of 1-to-5 in relation to journeymen, or; (iii) the Apprenticeable Craft or Trade is replacing at least one-thirtieth (1/30) of its journeymen annually through apprenticeship training, either on a statewide basis or on a local basis, or; (iv) if assignment of an apprentice to any Work performed under the Contract Documents would create a condition which would jeopardize such apprentice's life or the life, safety or property of fellow employees or the public at large, or if the specific task to which the apprentice is to be assigned is of such a nature that training cannot be provided by a journeyman. When such exemptions from the 1-to-5 ratio between apprentices and journeymen are granted to an organization which represents contractors in a specific trade on a local or statewide basis, the member contractors will not be required to submit individual applications for approval to local Joint Apprenticeship Committees, provided they are already covered by the local apprenticeship standards.

4.18.6.5 Contributions to Trust Funds. The Contractor or any Subcontractor, of any tier, who, performs any of the Work by employment of journeymen or apprentices in any Apprenticeable Craft or Trade and who is not contributing to a fund or funds to administer and conduct the apprenticeship program in any such craft or trade in the area of the site of the Work, to which fund or funds other contractors in the area of the site of the Work are contributing, shall contribute to the fund or funds in each craft or trade in which it employs journeymen or apprentices in the same amount or upon the same basis and in the same manner as the other contractors do, but where the trust fund administrators are unable to accept such funds, contractors not signatory to the trust agreement shall pay a like amount to the California Apprenticeship Council. The Division of Labor Standards Enforcement is authorized to enforce the payment of such contributions to such fund(s) as set forth in California Labor Code §227. Such contributions shall not result in an increase in the Contract Price.

4.18.6.6 Contractor's Compliance. The responsibility of compliance with this Article for all Apprenticeable Trades or Crafts is solely and exclusively that of the Contractor. All decisions of the Joint Apprenticeship Committee(s) under this Article are subject to the provisions of California Labor Code §3081. In the event the Contractor

willfully fails to comply with the provisions of this Article and California Labor Code §1777.5, pursuant to California Labor Code §1777.7, the Contractor shall: (i) be denied the right to bid on any public works contract for a period of one (1) year from the date the determination of non-compliance is made by the Administrator of Apprenticeship; and (ii) forfeit, as a civil penalty, Fifty Dollars ($50.00) for each calendar day of noncompliance. Notwithstanding the provisions of California Labor Code §1727, upon receipt of such determination, the District shall withhold such amount from the Contract Price then due or to become due. Any such determination shall be issued after a full investigation, a fair and impartial hearing, and reasonable notice thereof in accordance with reasonable rules and procedures prescribed by the California Apprenticeship Council. Any funds withheld by the District pursuant to this Article shall be deposited in the General Fund or other similar fund of the District. The interpretation and enforcement of California Labor Code §§1777.5 and 1777.7 shall be in accordance with the rules and procedures of the California Apprenticeship Council.

4.18.7 Employment of Independent Contractors. Pursuant to California Labor Code §1021.5, Contractor shall not willingly and knowingly enter into any agreement with any person, as an independent contractor, to provide any services in connection with the Work where the services provided or to be provided requires that such person hold a valid contractors' license issued pursuant to California Business and Professions Code §§7000 et seq. and such person does not meet the burden of proof of his/her independent contractor status pursuant to California Labor Code §2750.5. In the event that Contractor shall employ any person in violation of the foregoing, Contractor shall be subject to the civil penalties under California Labor Code §1021.5 and any other penalty provided by law. In addition to the penalties provided under California Labor Code §1021.5, Contractor's violation of this Article 4.18.7 or the provisions of California Labor Code §1021.5 shall be deemed an event of Contractor's default under Article 15.1 of these General Conditions. The Contractor shall require Subcontractors performing or providing any portion of the Work to adhere to and comply with the foregoing provisions.

4.19 Assignment of Antitrust Claims. Pursuant to California Government Code §4551, the Contractor and its Subcontractor(s), of any tier, hereby offers and agrees to assign to the District all rights, title and interest in and to all causes of action they may have under Section 4 of the Clayton Act, (15 U.S.C. §15) or under the Cartwright Act (California Business and Professions Code §§16700 et seq.), arising from purchases of goods, services or materials hereunder or any Subcontract. This assignment shall be made and become effective at the time the District tenders Final Payment to the Contractor, without further acknowledgment by the parties. If the District receives, either through judgment or settlement, a monetary recovery in connection with a cause of action assigned under California Government Code §§4550 et seq., the assignor thereof shall be entitled to receive reimbursement for actual legal costs incurred and may, upon demand, recover from the District any portion of the recovery, including treble damages, attributable to overcharges that were paid by the assignor but were not paid by the District as part of the Contract Price, less the expenses incurred by the District in obtaining that portion of the recovery. Upon demand in writing by the assignor, the District shall, within one year from such demand, reassign the cause of action assigned pursuant to this Article if the assignor has been or may have been injured by the violation of law for which the cause of action arose: and (i) the District has not been injured thereby; or (ii) the District declines to file a court action for the cause of action.

4.20 Limitations Upon Site Activities. Except in the circumstances of an emergency, no construction activities shall be permitted at or about the Site except during the District's hours and days set forth in the Special Conditions. Work performed outside of the hours and days noted in the Special Conditions will not result in adjustment of the Contract Time or the Contract Price; unless

Work outside of the hours and days noted in the Special Conditions is expressly authorized by the District.

4.21 Progress Reports; DSA Verified Reports.

4.21.1 DSA Verified Reports: Contractor Actions. A material obligation of the Contractor is the completion by the Contractor of all actions and activities which by the Contract Documents or by the Laws are the responsibility of the Contractor relating to DSA reporting requirements pursuant to Education Code §81141 (including amendments thereto) and issuance of DSA's Certificate of Compliance for the Project pursuant to Education Code §81147 (including amendments thereto) upon completion of the Work. The foregoing shall include without limitation, the timely preparation, completion and filing of Verified Reports during Project construction and the filing of the Final Verified Report with DSA within ten (10) days of the determination of Final Completion. Concurrently with submittal to DSA, the Contractor shall provide the District, District's Inspector, Architect and Construction Manager with copies of all Verified Reports completed by the Contractor and submitted to DSA.

4.21.2 District Withholdings From Final Payment. The completion and filing of the Final Verified Report with DSA by the Contractor is an express condition precedent to the District's disbursement of the Final Payment. If the Contractor fails to prepare and file the Final Verified Report with DSA within ten (10) days of the determination of Final Completion, the District may in the sole and exclusive discretion of the District retain and withhold an amount not to exceed ten percent (10%) of the Final Payment from disbursement to the Contractor as damages for the failure of the Contractor to have timely and completely discharged its obligations hereunder. The Contractor acknowledges and agrees that the foregoing withholdings by the District is a reasonable estimate of the damages and other losses the District will sustain due to the failure of the Contractor to have timely and fully discharged its obligations hereunder.

4.21.3 Progress Reports. Progress Reports shall be completed by the Contractor for each day of construction activities at the Site and submitted to the District or Project Manager not later than 9:00 A.M. of the ensuing business day.

ARTICLE 5: SUBCONTRACTORS

5.1 Subcontracts. Any Work performed for the Contractor by a Subcontractor shall be pursuant to a written agreement between the Contractor and such Subcontractor which specifically incorporates by reference the Contract Documents and which specifically binds the Subcontractor to the applicable terms and conditions of the Contract Documents, including without limitation, the policies of insurance required under Article 6 of these General Conditions and obligates the Subcontractor to assume toward the Contractor all the obligations and responsibilities of the Contractor which by the Contract Documents the Contractor assumes toward the District and the Architect. The foregoing notwithstanding, no contractual relationship shall exist, or be deemed to exist, between any Subcontractor and the District, unless the Contract is terminated and District, in writing, elects to assume the Subcontract. Each Subcontract for a portion of the Work shall provide that such Subcontract may be assigned to the District if the Contract is terminated by the District pursuant to Article 15 hereof, subject to the prior rights of the Surety if the District terminates the Contract for the Contractor's default. The Contractor shall provide to the District copies of all executed Subcontracts and Purchase Orders to which Contractor is a party within thirty (30) days after Contractor's execution of the Agreement. During performance of the Work, the Contractor shall, from time to time, as and when requested by the District, the Architect or the Project Manager provide the District with copies of any and all Subcontracts or Purchase Orders relating to the Work and all modifications thereto. The Contractor's failure or refusal, for any reason, to provide copies of such Subcontracts or Purchase Orders in accordance with the two preceding sentences is Contractor's default of a material term of the Contract Documents.

5.2 Subcontractor DIR Contractor Registration.

5.2.1 No Subcontractor Performance of Work Without DIR Registration. No portion of the Work is permitted to be performed by a Subcontractor unless the Subcontractor is a DIR Registered contractor. The foregoing DIR contractor registration requirement is applicable for all Subcontractors, including without limitation, lower tier Subcontractors and Subcontractors who are not identified in the Contractor's Subcontractors List.

5.2.2 Contractor Obligation to Verify Subcontractor DIR Registration Status. An affirmative and on-going obligation of the Contractor under the Contract Documents is the Contractor's verification that all Subcontractors are at all times during performance of the Work in full and strict compliance with DIR contractor registration requirements. The Contractor shall not permit or allow any Subcontractor to perform any Work without the Contractor's verification that the Subcontractor is in full and strict compliance with DIR contractor registration requirements.

5.2.3 Contractor Obligation to Request Substitution of Listed Subcontractor Who Is Not DIR Registered Contractor. If any Subcontractor identified in the Contractor's Subcontractors List submitted with the Contractor's proposal for the Work is not a DIR registered contractor at the time of opening of proposals for the Work or if a Subcontractor's DIR contractor registration lapses prior to or during a Subcontractor's performance of Work, the Contractor shall request the District's consent to substitute the Subcontractor who is not a DIR registered contractor pursuant to Labor Code §1771.1(c)(3) and/or Labor Code §1771.1(d).

5.3 Substitution of Listed Subcontractor.

5.3.1 Substitution Process. Request of the Contractor to substitute a listed Subcontractor will be considered only if in strict conformity with this Article 5.2 and California Public Contract Code §4107. All costs incurred by the District, including without limitation, costs of the District's Inspector, the Architect, the Project Manager or attorneys' fees in the review and evaluation of a request to substitute a listed Subcontractor shall be borne by the Contractor; such costs may be deducted by the District from the Contract Price then or thereafter due the Contractor.

5.3.2 Responsibilities of Contractor Upon Substitution of Subcontractor. The District's consent to Contractor's substitution of a listed Subcontractor shall not relieve Contractor from its obligation to complete the Work within the Contract Time and for the Contract Price. The substitution of a listed Subcontractor shall not, under any circumstance, result in, or give rise to any to any increase of the Contract Price or the Contract Time on account of such substitution. If the District consents to substitution of a listed Subcontractor, the Architect shall determine the extent to which, if any, revised or additional Submittals will be required of the newly substituted Subcontractor ("Substituted Subcontractor"). If the Architect determines that revised or additional Submittals are required of a Substituted Subcontractor, the Architect shall promptly notify the Contractor, in writing, of such requirement. In such event, revised or additional Submittals shall be submitted to Architect not later than thirty (30) days following the date of the Architect's written notice to the Contractor pursuant to the foregoing sentence; provided that if in the reasonable and good faith judgment of the Architect, the progress of the Work or completion of the Work requires submission of additional or revised Submittals by a Substituted Subcontractor in less than thirty (30) days, the Architect shall so state in its written notice to the Contractor. If the revised or additional Submittals are not submitted by Contractor within thirty (30) days, or such earlier time as determined by the Architect pursuant to the preceding sentence, following the Architect's written notice of the requirement for revised or additional Submittals, Contractor shall be subject to the per diem assessments for late Submittals as set forth in Article 4.7.2.1 of these General Conditions. Any revised or additional Submittals required pursuant to this Article 5.3.2 shall conform to the requirements of Article 4.7 of these General Conditions. Contractor shall reimburse the District for all fees and costs, including without limitation fees of the Architect, the District's administrative costs and DSA fees, incurred or associated with the processing, review and evaluation of any revised or additional Submittals required pursuant to this Article 5.3.2; the District may deduct such fees and costs from any portion of the Contract Price then or thereafter due the Contractor. In the event that additional

or revised Submittals are required pursuant to this Article 5.3.2, such requirement shall not result in an increase to the Contract Time or the Contract Price.

5.4 Subcontractors' Work. Whenever the Work of a Subcontractor is dependent upon the Work of the Contractor or another Subcontractor, the Contractor shall require the Subcontractor to: (i) coordinate its Work with the dependent Work; (ii) provide necessary dependent data and requirements; (iii) supply and/or install items to build into the dependent Work of others; (iv) make appropriate provisions for dependent Work of others; (v) carefully examine and understand the portions of the Contract Documents (including Drawings, Specifications and Field Clarifications) and Submittals relating to the dependent Work; and (vi) examine the existing dependent Work and verify that the dependent Work is in proper condition for the Subcontractor's Work. If the dependent Work is not in a proper condition, the Subcontractor shall notify the Contractor in writing and not proceed with the Subcontractor's Work until the dependent Work has been corrected or replaced and is in a proper condition for the Subcontractor's Work.

ARTICLE 6: INSURANCE; INDEMNITY; BONDS

6.1 Workers' Compensation Insurance; Employer's Liability Insurance. The Contractor shall purchase and maintain Workers' Compensation Insurance as will protect the Contractor from claims under workers' or workmen's compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. Contractor shall purchase and maintain Employer's Liability Insurance covering bodily injury (including death) by accident or disease to any employee which arises out of the employee's employment by Contractor. The Employer's Liability Insurance required of Contractor hereunder may be obtained by Contractor as a separate policy of insurance or as an additional coverage under the Workers' Compensation Insurance required to be obtained and maintained by Contractor hereunder. The limits of liability for the Employer's Liability Insurance required hereunder shall be as set forth in the Special Conditions.

6.2 Commercial General Liability. The Contractor shall purchase and maintain Commercial General Liability, including coverage for the types of claims set forth below which may arise out of or result from Contractor's performance of the Work: (i) claims for damages because of bodily injury, sickness or disease or death of any person other than the Contractor's employees; (ii) claims for damages insured by usual personal injury liability coverage; (iii) claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom; (iv) claims for damages because of bodily injury, death of a person or property damages arising out of ownership, maintenance or use of a motor vehicle; (v) contractual liability insurance applicable to the Contractor's obligations under the Contract Documents; (vi) Completed Operations; and (vii) Contractor's Pollution Liability.

6.3 Builder's Risk "All-Risk" Insurance. The Contractor, during the progress of the Work and until Final Acceptance of all Work by the District, shall maintain Builder's Risk "All-Risk" Completed Value Insurance Coverage on all insurable Work included under the Contract Documents which coverage is to provide extended coverage and insurance against vandalism and malicious mischief, perils of fire, sprinkler leakage, civil authority, sonic boom, collapse and flood upon the entire Work which is the subject of the Contract Documents, and including completed Work and Work in progress to the full insurable value thereof. Contractor's Builders Risk Insurance shall include coverage and insurance against the perils of earthquake if so indicated in the Special Conditions. Such insurance shall include the District as an additional named insured, and any other person with an insurable interest designated by the District as an additional named insured. The risk of damage to the Work due to the perils covered by the Builder's Risk "All Risk" Insurance, as well as any other hazard which might result in damage to the Work, is that of the

Contractor and the Surety, and no claims for such loss or damage shall be recognized by the District, nor will such loss or damage excuse the complete and satisfactory performance of the Contract by the Contractor.

6.4 Insurance Requirements.

6.4.1 Coverage Limits. Minimum coverage limits for each policy of insurance required of the Contractor hereunder are set forth in the Special Conditions.

6.4.2 Deductibles. The Contractor is solely and exclusively responsible for the payment of deductibles, if any, under any policy of insurance required of the Contractor hereunder, without adjustment to the Contract Price on account thereof.

6.4.3 No Modification or Cancellation Without Prior Notice to District. Coverages afforded under policies of insurance required of the Contractor shall include provisions to the effect that coverage thereunder will not be canceled or allowed to expire until at least thirty (30) days prior written notice has been given to the District. Should any policy of insurance be canceled before Final Acceptance of the Work by the District and the Contractor fails to immediately procure replacement insurance as required, the District reserves the right to procure such insurance and to deduct the premium cost thereof and other costs incurred by the District in connection therewith from any sum then or thereafter due the Contractor under the Contract Documents.

6.4.4 District Additional Insured. The District shall be an additional insured under the Contractor's Commercial Liability and Builders Risk policies of insurance. The additional Insured acknowledgement shall be submitted as a separate declaration from the Contractor's insurance provider (ACCORD form modifications are not acceptable).

6.4.5 Certificates of Insurance. Prior to commencing the Work, Contractor shall deliver to the District Certificates of Insurance evidencing the insurance coverages required by the Contract Documents. Failure or refusal of the Contractor to so deliver Certificates of Insurance may be deemed by the District to be a default of a material obligation of the Contractor under the Contract Documents, and thereupon the District may proceed to exercise any right or remedy provided for under the Contract Documents or at law. The Contractor shall, from time to time, furnish the District, when requested, with satisfactory proof of coverage of each type of insurance required by the Contract Documents; failure of the Contractor to comply with the District's request may be deemed by the District to be a default of a material obligation of the Contractor under the Contract Documents.

6.5 Subcontractors' Insurance. Contractor shall require that every Subcontractor, to obtain and maintain the policies of insurance set forth in Articles 6.1, 6.2 and 6.4 of these General Conditions; the coverages and limits of liability of such policies of insurance to be obtained and maintained by Subcontractors shall be as set forth in the Special Conditions. The policies of insurance to be obtained and maintained by Subcontractors hereunder are in addition to, and not in lieu of, Contractor obtaining and maintaining such policies of insurance. Each of the policies of insurance obtained and maintained by a Subcontractor hereunder shall conform with the requirements of this Article 6. Upon request of the District, Contractor shall promptly deliver to the District Certificates of Insurance evidencing that the Subcontractors have obtained and maintained policies of insurance in conformity with the requirements of this Article 6. Failure or refusal of the Contractor to provide the District with Subcontractors' Certificates of Insurance evidencing the insurance coverages required hereunder is a material default of Contractor hereunder.

6.6 Maintenance of Insurance. Any insurance bearing on the adequacy of performance of Work shall be maintained after the District's Final Acceptance of all of the Work for the full one year correction of Work period and any longer specific guarantee or warranty periods set forth in the Contract Documents. Should such insurance be canceled before the end of any such periods and the Contractor fails to immediately procure replacement insurance as specified, the District reserves the right to procure such insurance and to charge the cost thereof to the Contractor. Nothing contained

in these insurance requirements is to be construed as limiting the extent of the Contractor's responsibility for payment of damages resulting from its operations or performance of the Work under the Contract Documents, including without limitation the Contractor's obligation to pay Liquidated Damages. In no instance will the District's exercise of its option to occupy and use completed portions of the Work relieve the Contractor of its obligation to maintain insurance required under this Article until the date of Final Acceptance of the Work by the District, or such time thereafter as required by the Contract Documents. The insurer providing any insurance coverage required hereunder shall be to the reasonable satisfaction of the District.

6.7 Contractor's Insurance Primary. All insurance and the coverages thereunder required to be obtainedand maintained by Contractor hereunder, if overlapping with any policy of insurance maintained by the District, shall be deemed to be primary and non-contributing with any policy maintained by the District and any policy or coverage thereunder maintained by District shall be deemed excess insurance. To the extent that the District maintains a policy of insurance covering property damage arising out of the perils of fire or other casualty covered by the Contractor's Builder's Risk Insurance or the Comprehensive General Liability Insurance of the Contractor or any Subcontractor, the District, Contractor and all Subcontractors waive rights of subrogation against the others. The costs for obtaining and maintaining the insurance coverages required herein shall be included in the Contract Price.

6.8 Indemnity. Unless arising solely out of the active negligence, gross negligence or willful misconduct the District or the Architect, the Contractor shall indemnify, defend and hold harmless the Indemnified Parties who are: (i) the District and its Board of Trustees, officers, employees, agents and representatives (including the District's Inspector); (ii) the Architect its respective agents and employees; and (iii) if one is designated by the District for the Work, the Project Manager and its agents and employees. The Contractor's obligations hereunder includes indemnity, defense and hold harmless of the Indemnified Parties from and against any and all damages, losses, claims, demands or liabilities whether for damages, losses or other relief, including, without limitation attorneys' fees and costs which arise, in whole or in part, from the Work, the Contract Documents or the negligent, grossly negligent or willful acts, omissions or other conduct of the Contractor, any Subcontractor or any person or entity engaged by them for the Work. The Contractor's obligations under the foregoing include without limitation: (i) injuries to or death of persons; (ii) damage to property; or (iii) theft or loss of property; (iv) Stop Payment Notice claims asserted by any person or entity in connection with the Work; and (v) other losses, liabilities, damages or costs resulting from, in whole or part, any acts, omissions or other conduct of Contractor, any of Contractor's Subcontractors, of any tier, or any other person or entity employed directly or indirectly by Contractor in connection with the Work and their respective agents, officers or employees. If any action or proceeding, whether judicial, administrative, arbitration or otherwise, shall be commenced on account of any claim, demand or liability subject to Contractor's obligations hereunder, and such action or proceeding names any of the Indemnified Parties as a party thereto, the Contractor shall, at its sole cost and expense, defend the named Indemnified Parties in such action or proceeding with counsel reasonably satisfactory to the named Indemnified Parties. In the event that there shall be any judgment, award, ruling, settlement, or other relief arising out of any such action or proceeding to which any of the Indemnified Parties are bound by, Contractor shall pay, satisfy or otherwise discharge any such judgment, award, ruling, settlement or relief; Contractor shall indemnify and hold harmless the Indemnified Parties from any and all liability or responsibility arising out of any such judgment, award, ruling, settlement or relief. The Contractor's obligations hereunder are binding upon Contractor's Performance Bond Surety and these obligations shall survive notwithstanding Contractor's completion of the Work or the termination of the Contract.

6.9 Payment Bond; Performance Bond. Prior to commencement of the Work, the Contractor shall furnish a Performance Bond as security for Contractor's faithful performance of the Contract and a Labor and Material Payment Bond as security for payment of persons or entities performing work, labor or

furnishing materials in connection with Contractor's performance of the Work under the Contract Documents. Unless otherwise stated in the Special Conditions, the amounts of the Performance Bond and the Payment Bond required hereunder shall be one hundred percent (100%) of the Contract Price. Said Labor and Material Payment Bond and Performance Bond shall be in the form and content set forth in the Contract Documents. The failure or refusal of the Contractor to furnish either the Performance Bond or the Labor and Material Payment Bond in strict conformity with this Article 6.9 may be deemed by the District as a default by the Contractor of a material obligation hereunder. The Surety on any bond required under the Contract Documents shall be an Admitted Surety Insurer as that term is defined in California Code of Civil Procedure §995.120.

ARTICLE 7: CONTRACT TIME

7.1 Completion of the Work Within Contract Time. Unless otherwise expressly provided in the Contract Documents, the Contract Time is the period of time, including authorized adjustments thereto, allotted in the Contract Documents for achieving Completion of the Work. The date for commencement of the Work is the date established by the Notice to Proceed issued by the District pursuant to the Agreement, which shall not be postponed by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible. The date of Completion is the date certified by the Architect and the District's Inspector as such in accordance with the Contract Documents.

7.2 Progress and Completion of the Work.

7.2.1 Time of Essence. Time limits stated in the Contract Documents are of the essence. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing and achieving Completion of the Work. The Contractor shall employ and supply a sufficient force of workers, material and equipment, and prosecute the Work with diligence so as to maintain progress, to prevent Work stoppage and to achieve Completion of the Work within the Contract Time.

7.2.2 Correction and Completion of Project Work per bid documents, plans and specifications Prior to One Hundred Percent Completion.

7.2.2.1 Punchlist. Upon achieving Completion of the Work, the District, the District's Inspector, the Project Manager, if any, the Architect and the Contractor shall jointly inspect the Work and prepare a comprehensive list of items of the Work to be corrected or completed by the Contractor ("the Punchlist"). The exclusion of, or failure to include, any item on the Punchlist shall not alter or limit the obligation of the Contractor to complete or correct any portion of the Work in accordance with the Contract Documents.

7.2.2.2 Time for Completing Punchlist Items. In addition to establishing the Punchlist items pursuant to Article 7.2.3.1, the Project Manager, if any, Contractor and Architect shall, after the joint inspection, establish a reasonable time for Contractor's completion of all Punchlist items. If mutual agreement is not reached to establish the time for the Contractor's completion of Punchlist items, the Architect shall determine such time, and in such event, the time determined by the Architect shall be final and binding upon the District and Contractor so long as the Architect's determination is made in good faith. The Contractor shall promptly and diligently proceed to complete all Punchlist items within the time established. If the Contractor fails or refuses, for any reason, to complete all Punchlist items within the time established, Contractor shall be subject to assessment of Liquidated Damages in accordance with Article 7.4 hereof. The foregoing notwithstanding, if the Contractor fails or refuses to complete all Punchlist items, the District may in its sole and exclusive discretion and without further notice to Contractor, elect to cause the completion of all remaining Punchlist items provided, however that such election by the District is in addition to and not in lieu of any other right or remedy of the District under the Contract Documents or at law. If the District elects to complete Punchlist items of the Work, pursuant to the foregoing, Contractor shall be responsible

for all costs incurred by the District in connection herewith and the District may deduct such costs from the Contract Price then or thereafter due the Contractor, if these costs exceed the remaining Contract Price due to the Contractor, the Contractor and the Performance Bond Surety are jointly and severally liable to District for any such excess costs.

7.2.3 One Hundred Percent Completion. Completion is that stage in the progress of the Work when the Work or any designated portion thereof (whether described as milestones, phases, segments or other similar terms) is complete in accordance with the Contract Documents so the District can occupy or use the Work for its intended purpose. Completion shall be determined by the Architect, Project Manager, if any, and the District's Inspector upon request by the Contractor in accordance with the Contract Documents. The good faith and reasonable determination of Completion by the District's Inspector, Project Manager, if any and the Architect shall be controlling and final.

7.2.4 Contractor Responsibility for Multiple Inspections. If the Contractor requests determination of Completion or Final Completion by the District's Inspector, Project Manager, if any, and the Architect and it is determined by the District's Inspector, Project Manager, if any, or the Architect that the Work does not then justify certification of Completion or Final Completion and re-inspection is required at a subsequent time to make such determination, the Contractor shall be responsible for all costs of such re-inspection, including without limitation, the fees of the Architect, Project Manager, if any, and the District's Inspector. The District may deduct such costs from the Contract Price then due or thereafter due to the Contractor.

7.2.5 Final Acceptance. Final Acceptance of the Work shall occur upon approval of the Work by the District's Board of Trustees; such approval shall be submitted for adoption at the next regularly scheduled meeting of the District's Board of Trustees after the determination of Final Completion. The commencement of any warranty or guarantee period under the Contract Documents is the date upon which the District's Board of Trustees approves of the Final Acceptance of the Work.

7.3 Construction Schedule.

7.3.1 Submittal of Preliminary Construction Schedule. Within five (14) days following execution of the Agreement, the Contractor shall prepare and submit to the District, the Project Manager, if any, and the Architect a Preliminary Construction Schedule indicating, in graphic form, the estimated rate of progress and sequence of all Work required under the Contract Documents. The purpose of the Preliminary Construction Schedule is to assure adequate planning and execution of the Work so that it is completed within the Contract Time and to permit evaluation of the progress of the Work. Unless otherwise provided in the Special Conditions, the Construction Schedules required under this Article 7 shall; (i) be prepared with a commercially available computer software program in a critical path format; (ii) indicate the date(s) for commencement and completion of various portions of the Work including without limitation, procurement, fabrication and delivery of major items, materials or equipment; (iii) indicate manpower and other resources required for completion of each Construction Schedule activity; (iv) indicate costs for completion of each Construction Schedule activity; (v) identify each Submittal required by the Contract Documents, the date for the Contractor's submission of each Submittal and the date for the return of the reviewed Submittal to the Contractor. The Contractor may submit a Preliminary Construction Schedule depicting completion of the Work in a duration shorter than the Contract Time; provided that such Preliminary Construction Schedule shall not be a basis for adjustment to the Contract Price in the event that completion of the Work shall occur after the time depicted therein, nor shall such Preliminary Construction Schedule be the basis for any extension of the Contract Time, the Contractor's entitlement to any extension of the Contract Time shall be based upon the Contract Time and not on any shorter duration which may be depicted in the Contractor's Preliminary Construction Schedule. If the Construction

Schedules required under this Article 7.3 incorporate therein any "float" time, such float shall be deemed to jointly belong to and owned by the District and the Contractor. As used herein, "float time" shall be deemed to refer to the time between earliest finish date and the latest finish date of each activity shown on the Construction Schedule.

7.3.2 Review of Preliminary Construction Schedule. The District, the Project Manager, if any, and the Architect shall review the Preliminary Construction Schedule submitted by the Contractor pursuant to Article 7.3.1 above for conformity with the requirements of the Contract Documents. Within fifteen (15) days of the date of receipt of the Preliminary Construction Schedule, the Preliminary Construction Schedule will be returned to the Contractor with comments to the form or content thereof. Review of the Preliminary Construction Schedule and any comments thereto by the District, the Project Manager and/or the Architect shall not be deemed to be the assumption of construction means, methods or sequences by the District, the Project Manager or the Architect, all of which remain the Contractor's obligations under the Contract Documents.

7.3.3 Preparation and Submittal of Contract Construction Schedule. Within ten (21) days of the District's return of the Preliminary Construction Schedule to the Contractor pursuant to Article 7.3.2 above, the Contractor shall prepare and submit to the Architect and the Project Manager, if any, the Construction Schedule which incorporates therein the comments to the Preliminary Construction Schedule. Upon the Contractor's submittal of such Construction Schedule, the District, the Project Manager and the Architect shall review the same for purposes of determining conformity with the requirements of the Contract Documents. Within fifteen (15) days of the receipt of the Construction Schedule, the District will approve such Construction Schedule or will return the same to the Contractor with comments to the form or content. In the event there are comments to the form or content thereof, the Contractor, shall within seven (7) days of receipt of such comments, revise and resubmit the Construction Schedule incorporating therein such comments. Upon the District's approval of the form and content of a Construction Schedule, the same shall be deemed the "Approved Construction Schedule." The District's approval of a Construction Schedule shall be for the sole and limited purpose of determining conformity with the requirements of the Contract Documents. By the Approved Construction Schedule, the District shall not be deemed to have exercised control over, or approval of, construction means, methods or sequences, all of which remain the responsibility and obligation of the Contractor in accordance with the terms of the Contract Documents. Further, the Approved Construction Schedule shall not operate to limit or restrict any of Contractor's obligations under the Contract Documents nor relieve the Contractor from the full, faithful and timely performance of such obligations in accordance with the terms of the Contract Documents. The activities, commencement and completion dates of activities, and the sequencing of activities depicted on the Approved Construction Schedule shall not be modified or revised by the Contractor without the prior consent, or direction, of the District and the Architect. Updates to the Approved Construction Schedule pursuant to Article 7.3.5 below shall not be deemed revisions to the Approved Construction Schedule. If the Approved Construction Schedule depicts completion of the Work in a duration shorter than the Contract Time, the same shall not be a basis for an adjustment of the Contract Time or the Contract Price in the event that actual completion of the Work shall occur after such the time depicted in such Approved Construction Schedule. In such event, the Contract Price shall not be subject to adjustment on account of any additional costs incurred by the Contractor to complete the Work prior to the Contract Time, as adjusted in accordance with the terms of the Contract Documents. Any adjustment of the Contract Time or the Contract Price shall be based upon the Contract Time set forth in the Contract Documents and not any shorter duration which may depicted in the Approved Construction Schedule.

7.3.4 Revisions to Approved Construction Schedule. In the event that the progress of the Work or the sequencing of the activities of the Work shall materially differ from that indicated in the Approved Construction Schedule, as determined by the District in its reasonable discretion

and judgment, the District may direct the Contractor to revise the Approved Construction Schedule; within fifteen (15) days of the District's direction, the Contractor shall prepare and submit to the Architect and the Project Manager a revised Approved Construction Schedule, for review and approval by the District. The Contractor may request consent of the District to revise the Approved Construction Schedule. Any such request shall be considered by the District only if in writing setting forth the Contractor's proposed revision(s) to the Approved Construction Schedule and the reason(s) therefor. The District may consent to, or deny, any such request of the Contractor to revise the Approved Construction Schedule in its reasonable discretion.

7.3.5 Updates to Approved Construction Schedule. The Contractor shall monitor and update the Approved Construction Schedule on a monthly basis, or more frequently as required by the conditions or progress of the Work, or as may be requested by the District. The Contractor shall provide the District, the Project Manager and the Architect with updated Approved Construction Schedules indicating progress achieved and activities commenced or completed within the prior updated Approved Construction Schedule. Updates to the Approved Construction Schedule shall not include any revisions to the activities, commencement and completion dates of activities or the sequencing of activities depicted on the Approved Construction Schedule. Any such revisions to the Approved Construction Schedule shall result in the District's rejection of such update and Contractor shall, within seven (7) days of the District's rejection of such update, submit to the Architect and the Project Manager an Updated Approved Construction Schedule which does not incorporate any such revisions. If requested by the District, the Contractor shall also submit, with its updates to the Approved Construction Schedule a narrative statement including a description of current and anticipated problem areas of the Work, delaying factors and their impact, and an explanation of corrective action taken or proposed by the Contractor. If the progress of the Work is behind the Approved Construction Schedule, the Contractor shall indicate what measures will be taken to place the Work back on schedule. The District may, from time to time, and in the District's sole and exclusive discretion, transmit to the Contractor's Performance Bond Surety the Approved Construction Schedule, any updates thereof and the narrative statement described hereinabove. The District's election to transmit, or not to transmit such information, to the Contractor's Performance Bond Surety shall not limit the Contractor's obligations under the Contract Documents.

7.3.6 Contractor Responsibility for Construction Schedule. The Contractor shall be responsible for the preparation, submittal and maintenance of the Construction Schedules required by the Contract Documents, and any failure of the Contractor to do so may be deemed by the District as the Contractor's default in the performance of a material obligation under Contract Documents. Any and all costs or expenses required or incurred to prepare, submit, maintain, and update the Construction Schedules shall be solely that of the Contractor and no such cost or expense shall be charged to the District. The Contract Price shall not be subject to adjustment on account of costs, fees or expenses incurred or associated with the Contractor's preparation, submittal, and maintenance or updating of the Construction Schedules.

7.4 Adjustment of Contract Time. If Completion is delayed, adjustment, if any, to the Contract Time on account of such delay shall be in accordance with this Article 7.4.

7.4.1 Excusable Delays. If Completion of the Work is delayed by Excusable Delays, the Contract Time shall be subject to adjustment for such reasonable period of time as determined by the Architect; Excusable Delays shall not result in any increase in the Contract Price. Excusable Delays refer to unforeseeable and unavoidable casualties or other unforeseen causes beyond the control, and without fault or neglect, of the Contractor, any Subcontractor, Material Supplier or other person directly or indirectly engaged by the Contractor in performance of any portion of the Work. Excusable Delays include unanticipated and unavoidable labor disputes, unusual and unanticipated delays in transportation of equipment, materials or Construction Equipment reasonably necessary for completion and proper execution of the Work, unanticipated unusually severe weather conditions or DSA directive to stop the Work. Neither

the financial resources of the Contractor or any person or entity directly or indirectly engaged by the Contractor in performance of any portion of the Work shall be deemed conditions beyond the control of the Contractor. If an event of Excusable Delay occurs, the Contract Time shall be subject to adjustment hereunder only if the Contractor establishes: (i) full compliance with all applicable provisions of the Contract Documents relative to the method, manner and time for Contractor's notice and request for adjustment of the Contract Time; (ii) that the event(s) forming the basis for Contractor's request to adjust the Contract Time are outside the reasonable control and without any fault or neglect of the Contractor or any person or entity directly or indirectly engaged by Contractor in performance of any portion of the Work; and (iii) that the event(s) forming the basis for Contractor's request to adjust the Contract Time directly and adversely impacted the progress of the Work as indicated in the Approved Construction Schedule or the most recent updated Approved Construction Schedule relative to the date(s) of the claimed event(s) of Excusable Delay. The foregoing provisions notwithstanding, if the Special Conditions set forth a number of "Rain Days" to be anticipated during performance of the Work, the Contract Time shall not be adjusted for rain related unusually severe weather conditions until and unless the actual number of Rain Days during performance of the Work exceeds those noted in the Special Conditions and such additional Rain Days directly and adversely impact the critical path progress of the Work as depicted in the Approved Construction Schedule or the most recent updated Approved Construction Schedule relative to the date(s) of such additional Rain Days.

7.4.2 Compensable Delays. If Completion of the Work is delayed and such delay is caused by the acts or omissions of the District, the Architect, or separate contractor employed by the District (collectively "Compensable Delays"), upon Contractor's request and notice, in strict conformity with Articles 7 and 9 of these General Conditions, the Contract Time will be adjusted by Change Order for such reasonable period of time as determined by the Architect and the District. In accordance with California Public Contract Code §7102, if the Contractor's progress is delayed by any of the events described in the preceding sentence, Contractor shall not be precluded from the recovery of damages directly and proximately resulting therefrom, provided that the District is liable for the delay, the delay is unreasonable under the circumstances involved and the delay was not within the reasonable contemplation of the District and the Contractor at the time of execution of the Agreement. In such event, Contractor's damages, if any, shall be limited to direct, actual and unavoidable additional costs of labor, materials or Construction Equipment directly resulting from such delay, and shall exclude indirect or other consequential damages, including without limitation, home office expenses, bond capacity impairment or loss of prospective economic advantage. Except as expressly provided for herein, Contractor shall not have any other claim, demand or right to adjustment of the Contract Price arising out of delay, interruption, hindrance or disruption to the progress of the Work. Adjustments to the Contract Price and the Contract Time, if any, on account of Changes to the Work or Suspension of the Work shall be governed by the applicable provisions of the Contract Documents, including without limitation, Articles 9 and 14 of these General Conditions.

7.4.3 Unexcusable Delays. Unexcusable Delays refer to any delay to the progress of the Work caused by events or factors other than those specifically identified in Articles 7.4.1 and 7.4.2 above. Neither the Contract Price nor the Contract Time shall be adjusted on account of Unexcusable Delays.

7.4.4 Adjustment of Contract Time.

7.4.4.1 Procedure for Adjustment of Contract Time. The Contract Time shall be subject to adjustment only in strict conformity with applicable provisions of the Contract Documents. Failure of Contractor to request adjustment(s) of the Contract Time in strict conformity with applicable provisions of the Contract Documents shall be deemed Contractor's waiver of the same.

7.4.4.2 Limitations Upon Adjustment of Contract Time on Account of Delays. Any adjustment of the Contract Time on account of an Excusable Delay or a Compensable Delay shall be limited as set forth herein. If an Excusable Delay and a Compensable Delay occur concurrently, the maximum extension of the Contract Time shall be the number of days from the commencement of the first delay to the cessation of the delay which ends last. If an Unexcusable Delay occurs concurrently with either an Excusable Delay or a Compensable Delay, the maximum extension of the Contract Time shall be the number of days, if any, which the Excusable Delay or the Compensable Delay exceeds the period of time of the Unexcusable Delay. In addition to the foregoing limitations upon extension of the Contract Time, no adjustment of the Contract Time shall be made on account of any Excusable Delays or Compensable Delays unless such delay(s) actually and directly impact Work or Work activities on the critical path of the then current and updated Approved Construction Schedule as of the date on which such delay first occurs. The District shall not be deemed in breach of, or otherwise in default of any obligation hereunder, if the District shall deny any request by the Contractor for an adjustment of the Contract Time for any delay which does not actually and directly impact Work or Work activities on the critical path of the then current and updated Approved Construction Schedule.

7.5 Liquidated Damages. Should the Contractor neglect, fail or refuse to: (i) submit Submittals in accordance with the Approved Construction Schedule; (ii) achieve Completion of the Work or designated portions thereof within the Contract Time, (subject to adjustments authorized under the Contract Documents); (iii) or to complete Punchlist items within the time established pursuant to the Contract Documents, the Contractor agrees to pay to the District the amount of per diem Liquidated Damages set forth in the Special Conditions, not as a penalty but as Liquidated Damages, for every day beyond the Contract Time, as adjusted, until Submittals are submitted, Completion or completion of the Punchlist items are achieved. The Liquidated Damages amounts set forth in the Special Conditions are agreed upon by and between the Contractor and the District because of the difficulty of fixing the District's actual damages in the event of delayed submission of Submittals, Completion or completion of Punchlist items. The Contractor and the District specifically agree that said amounts are reasonable estimates of the District's damages in such event, and that such amounts do not constitute a penalty. Liquidated Damages may be deducted from the Contract Price then or thereafter due the Contractor. The Contractor and the Surety shall be liable to the District for any Liquidated Damages exceeding any amount of the Contract Price then held or retained by the District. In the event that the Contractor shall fail or refuse to complete Punchlist items and the District elects to exercise its right to cause completion or correction of such items pursuant to Article 7.2.3.2 hereof, the District's assessment of Liquidated Damages pursuant to the foregoing shall be in addition, and not in lieu of, the District's right to charge Contractor with the cost of completing or correcting such items of the Work, as provided for under Article 7.2.3.2. The Contractor and the District acknowledge and agree that the provisions of this Article 7.5 are reasonable under the circumstances existing at the time of the Contractor's execution of the Agreement.

ARTICLE 8: CONTRACT PRICE

8.1 Contract Price. The Contract Price is the amount stated in the Agreement and subject to adjustments thereto in accordance with the Contract Documents, is the total amount payable by the District to the Contractor for completion of the Work and other obligations of the Contractor under the Contract Documents. The District's payment of the Contract Price to the Contractor shall be in accordance with the Contract Documents.

8.2 Cost Breakdown. Within fifteen (15) days of the execution of the Agreement by Contractor, Contractor shall furnish, in a form acceptable to the District, a detailed estimate and complete Cost Breakdown of the Contract Price. The Cost Breakdown is subject to the District's review

and approval of the form and content thereof. If the District objects to any portion of the Cost Breakdown, within ten (10) days of the District's receipt of the Cost Breakdown, the District shall notify the Contractor, in writing of the District's objection(s) to the Cost Breakdown. Within five (5) days of the date of the District's written objection(s), Contractor shall submit a revised Cost Breakdown to the District for review and approval. The foregoing procedure for the preparation, review and approval of the Cost Breakdown shall continue until the District has approved of the entirety of the Cost Breakdown. Upon the District's approval of the Cost Breakdown, the Cost Breakdown shall not be thereafter modified or amended by the Contractor without the prior consent and approval of the District, which may be granted, conditioned or withheld in the sole discretion of the District. Notwithstanding any provision of the Contract Documents to the contrary, payment of the Contractor's overhead, supervision and general conditions costs and profit, as such items are reflected in the Cost Breakdown, shall be made by the District in equal installments with its disbursements of Progress Payments and the Final Payment with the amount of each such installment equal to the aggregate amount of such items as reflected in the Cost Breakdown divided by the number of months of the Contract Time.

8.3 Progress Payments.

8.3.1 Applications for Progress Payments. During the Contractor's performance of the Work, the Contractor shall submit monthly, on the first working day of each month, to the District, District's Inspector, Project Manager, if any, and the Architect, Applications for Progress Payments ("Payment Applications"), on forms approved by the District, setting forth an itemized estimate of Work completed in the preceding month for the purpose of the District's making of Progress Payments thereon. Values utilized in the Payment Applications shall be based upon the District approved Cost Breakdown pursuant to Article 8.2 above provided that such values are only for determining the basis of Progress Payments to Contractor, and shall not be considered as fixing a basis for adjustments, whether additive or deductive, to the Contract Price, or for determining the extent of Work actually completed.

8.3.2 Payment Application Review for Determination of Proper Payment Application. Pursuant to Public Contract Code §20104.50, upon receipt of a Payment Application, the District's Inspector, the Project Manager, if any, and the Architect will review the Payment Application as soon as practicable for the purpose of determining that the Payment Application is a proper Payment Application. A Payment Application is "proper" only if information required by the form of Payment Application is completely and accurately provided by the Contractor and the Payment Application is accompanied by: (i) a summary listing of the Subcontractors/Material Suppliers entitled to payment of any portion of the requested Progress Payment, along with the amount of payment each Subcontractor/Material Supplier is entitled to receive from the Contractor from the proceeds of the requested Progress Payment; (ii) completed and executed form of Verification of Certified Payroll Records Submittal To Labor Commissioner; (iii) duly completed and executed forms of Conditional Waiver and Release of Rights Upon Progress Payment in accordance with California Civil Code §8132 of the Contractor and Subcontractors/Material Suppliers covering the Progress Payment requested; (iv) duly completed and executed forms of Unconditional Waiver and Release of Rights upon Progress Payment in accordance with California Civil Code §8134 of the Contractor and Subcontractors/Material Suppliers covering the Progress Payment received by the Contractor under the immediately preceding Payment Application; (v) if applicable, a current union statement reflecting that the Contractor and Subcontractors are current in the payment of any supplemental fringe benefits required pursuant to any collective bargaining agreement to which the Contractor or any such Subcontractor is a party to or is otherwise bound by; and (vi) a certification by the Contractor that it has continuously maintained the Record Drawings reflecting the actual as-built conditions of the Work performed be for which the Progress Payment is requested, it being understood that such certification is subject to verification by the District, Architect or the Project Manager prior to disbursement of the Progress Payment. Pursuant to

Public Contract Code §20104.50, if a Payment Application determined by the District not to be a proper Payment Application it shall be returned by the District to the Contractor as soon as is practicable after receipt thereof, but in no event not more than seven (7) days after receipt. The District's return of any Payment Application pursuant to the preceding sentence shall be accompanied by a written document setting forth the reason(s) why the Payment Application is not proper.

8.3.3 Verification of Work Completed. Upon receipt of a Payment Application, the Architect, Project Manager, if any and the District's Inspector shall inspect and verify the Work to determine whether it has been performed in accordance with requirements of the Contract Documents and to determine the portion of the Payment Application which is properly due to the Contractor under the terms of the Contract Documents.

8.3.4 District's Disbursement of Progress Payments.

8.3.4.1 Timely Disbursement of Progress Payments. Pursuant to Public Contract Code §20104.50, within thirty (30) days after the District's receipt of a proper Payment Application, there shall be paid, by District, to Contractor a sum equal to ninety-five percent (95%) of the value of the Work indicated in the Payment Application which is actually in place as of the date of the Payment Application, as verified by the District's Inspector, Project Manager, if any, and the Architect and the pro rata portion of the Contractor's overhead, supervision and general conditions costs and profit for that month; provided, however, that the District's obligation to disburse any Progress Payment shall be subject to the District's receipt of all documents set forth in Article 8.3.2 above, each and all of which are conditions precedent to the District's obligation to disburse Progress Payments. If a Payment Application is determined not to be proper due to the failure or refusal of the Contractor to submit documents with the Payment Application, as required by Article 8.3.2, or incompleteness or inaccuracies in any such documents submitted or if it is reasonably determined that the Record Drawings have not been continuously maintained to reflect the actual as built conditions of the Work completed in the period for which the Progress Payment is requested, the thirty (30) day period hereunder for the District's timely disbursement of a Progress Payment is deemed to commence on the date that the District is actually in receipt of documents not submitted with the Payment Application, or corrections to documents with the Payment Application so as to render them complete and accurate, or the date upon which the Contractor accurately and fully completes preparation of the Record Drawings relating to the Work for which the Progress Payment is requested.

8.3.4.2 Untimely Disbursement of Progress Payments. Pursuant to Public Contract Code §20104.50, if the District fails to make a Progress Payment within thirty (30) days after receipt of an undisputed and proper Payment Application, the District shall pay the Contractor interest on the undisputed amount of such Payment Application at the legal rate of interest set forth in California Code of Civil Procedure §685.010(a). The foregoing notwithstanding, if the District determines that any Payment Application is not proper, pursuant to Article 8.3.2 above, and the District does not return such Payment Application within the seven (7) day period provided for in Article 8.3.2, the period of time for the District's disbursement of the Progress Payment on such Payment Application without incurring interest liability shall be reduced by the number of days exceeding the seven (7) day return period.

8.3.4.3 District's Right to Disburse Payments by Joint Checks. The District, may, in its sole discretion, issue joint checks to the Contractor and Subcontractors/Material Suppliers in satisfaction of its obligation to make Progress Payments or the Final Payment due hereunder.

8.3.4.4 No Waiver of Defective or Non-Conforming Work. The approval of any Payment Application or the disbursement of any Progress Payment to the Contractor shall not be deemed nor constitute acceptance of defective or non-conforming Work.

8.3.5 Progress Payments for Changed Work. The Contractor's Payment Applications may

include requests for payment on account of Changes in the Work which have been properly authorized and approved by the District's Inspector, the Architect and all other governmental agencies with jurisdiction over such Change in accordance with the terms of the Contract Documents and for which a Change Order has been issued. Except as provided for herein, no other payment shall be made by the District for Changes in the Work.

8.3.6 Materials or Equipment Not Incorporated Into the Work.

8.3.6.1 Limitations Upon Payment. Except as expressly provided for herein, no payments shall be made by the District on account of any item of the Work, including without limitation, materials or equipment which, at the time of the Contractor's submittal of a Payment Application, has/have not been incorporated into and made a part of the Work.

8.3.6.2 Materials or Equipment Delivered and Stored at the Site. The District may, in its sole and exclusive discretion, make payment for materials or equipment not yet incorporated into the Work if, at or prior to the time of the Contractor's submittal of a Payment Application requesting payment for such materials or equipment if all of the following are complied with: (i) the materials or equipment have been delivered to the Site; (ii) adequate arrangements, reasonably satisfactory to the District, have been made by the Contractor to store and protect such materials or equipment at the Site including without limitation, insurance reasonably satisfactory to the District, covering and protecting against the risk of loss, destruction, theft or other damage to such materials or equipment while in storage; and (iii) the establishment of procedures reasonably satisfactory to the District by which title to such materials or equipment will be vested in the District upon the District's payment therefor. The Contractor acknowledges that the discretion to make, or not to make, payment for materials or equipment delivered or stored at the Site pursuant to the preceding sentence shall be exercised exclusively by the District; the District's exercise of discretion not to make payment shall not be deemed the District's default hereunder. If the District elects to make payment for materials or equipment delivered and stored at the Site, the costs and expenses incurred to comply with the requirements of (ii) and (iii) of this Article 8.3.6.2 shall be borne solely and exclusively by the Contractor and no payment shall be made by the District on account of such costs and expenses.

8.3.6.3 Materials or Equipment Not Delivered or Stored at the Site. No payments shall be made by the District for materials or equipment to be incorporated into the Work where such materials or equipment have not been delivered or stored at the Site or which are in the process of fabrication or transportation to the Site.

8.3.7 Exclusions From Progress Payments. In addition to the District's right to withhold disbursement of any Progress Payment provided for in the Contract Documents, neither the Contractor's Payment Application shall include, nor shall the District be obligated to disburse any portion of the Contract Price for amounts which the Contractor does not intend to pay any Subcontractor or Material Supplier because of a dispute or any other reason.

8.3.8 Title to Work. The Contractor warrants that title to all Work covered by an Payment Application will pass to the District no later than the time of payment. The Contractor further warrants that upon submittal of a Payment Application, all Work for which a Progress Payment has been previously disbursed and the Contractor has received payment from the District therefor shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, Material Suppliers or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

8.3.9 Substitute Security for Retention. Pursuant to California Public Contract Code §22300, eligible and equivalent securities may be substituted for any monies withheld by the District to ensure the Contractor's performance under the Contract Documents at the request and expense of the Contractor and in conformity with the provisions of California Public Contract Code

§22300. The foregoing and the provisions of California Public Contract Code §22300 notwithstanding, failure of the Contractor to request the substitution of eligible and equivalent securities for monies to be withheld by the District within ten (10) days following the date of award of the Contract to Contractor shall be deemed a waiver of such right.

8.4 Final Payment.

8.4.1 Application for Final Payment. When the Contractor has achieved Final Completion of the Work and has otherwise fully performed its obligations under the Contract Documents, the Contractor shall submit an Application for Final Payment on such form as approved by the District. Thereupon, the Architect, Project Manager, if any, and the District's Inspector will promptly make a final inspection of the Work and when the Architect, Project Manager, if any and the District's Inspector find the Work acceptable under the Contract Documents and that the Contract has been fully performed by the Contractor, the Architect, Project Manager, if any, and the District's Inspector will thereupon promptly approve the Application for Final Payment, stating that to the best their knowledge, information and belief, the Work has been completed in accordance with the terms of the Contract Documents. The Final Payment shall include the remaining balance of the Contract Price and any retention from Progress Payments previously withheld by the District.

8.4.2 Conditions Precedent to Disbursement of Final Payment. Neither Final Payment nor any remaining Contract Price shall become due until the Contractor submits to the District each and all of the following, the submittal of which are conditions precedent to the District's obligation to disburse the Final Payment: (i) an affidavit or certification by the Contractor that payrolls, bills for materials and other indebtedness incurred in connection with the Work for which the District or the District's property may or might be responsible or encumbered have been paid or otherwise satisfied; (ii) a certificate evidencing that insurance required by the Contract Documents to remain in force after the Contractor's receipt of Final Payment is currently in effect; (iii) a written statement that the Contractor knows of no One Hundred Percent reason that the insurance will not be renewable to cover any period following Final Payment as required by the Contract Documents; (iv) consent of the Surety on the Labor and Material Payment Bond and Performance Bond, to Final Payment if required; (v) duly completed and executed forms of Conditional or Unconditional Waivers and Releases of rights upon Final Payment of the Contractor, Subcontractors/Material Suppliers in accordance with California Civil Code §§8136 or 8138, with each of the same stating that there are, or will be, no claims for additional compensation after disbursement of the Final Payment; (vi) Operations and Maintenance manuals and separate warranties provided by any manufacturer or distributor of any materials or equipment incorporated into the Work; (vii) the Record Drawings; (viii) the form of Guarantee included in the Contract Documents duly executed by an authorized representative of the Contractor; (ix) any and all other items or documents required by the Contract Documents to be delivered to the District upon completion of the Work; (x) the completion and submittal of all reports required by the Contract Documents, including without limitation, verified reports required by applicable provisions of the California Code of Regulations; and (xi) if required by the District, such other data establishing payment or satisfaction of obligations such as receipts, releases and waivers of liens, Stop Payment Notices, claims, security interest or encumbrances arising out of the Contract to the extent and in such form as may be required by the District.

8.4.3 Disbursement of Final Payment. Provided that the District is then in receipt of all documents and other items in Article 8.4.2 above as conditions precedent to the District's obligation to disburse Final Payment, not later than sixty (60) days following Final Acceptance the District shall disburse the Final Payment to the Contractor. Pursuant to California Public Contract Code §7107, if there is any dispute between the District and the Contractor at the time that disbursement of the Final Payment is due, the District may withhold from disbursement of the Final Payment an amount not to exceed one hundred fifty percent (150%) of the amount in dispute. If the Contractor fails to timely submit completed DSA Reports in accordance with

Article 4.21.1 above, the Final Payment due the Contractor shall be reduced in accordance with Article 4.21.2 above.

8.4.4 Waiver of Claims. The Contractor's acceptance of the Final Payment is a waiver and release by the Contractor of any and all claims against the District for compensation or otherwise in connection with the Contractor's performance of the Contract.

8.4.5 Claims Asserted After Final Payment. Any lien, Stop Payment Notice or other claim filed or asserted after the Contractor's acceptance of the Final Payment by any Subcontractor, laborer, Material Supplier or others in connection with or for Work performed under the Contract Documents shall be the sole and exclusive responsibility of the Contractor and the Surety. The Contractor and Surety shall indemnify, defend and hold harmless the District and its officers, agents, representatives and employees from and against any claims, demands or judgments arising or associated therewith, including without limitation attorney's fees incurred by the District in connection therewith.

8.5 Withholding of Payments. The District may withhold any Progress Payment or the Final Payment, in whole or in part, or backcharge the Contractor to the extent it may deem advisable to protect the District on account of: (i) defective Work or Work not in conformity with the requirements of the Contract Documents which is not remedied; (ii) failure of the Contractor to make payments when due Subcontractors/Material Suppliers; (iii) claims filed or reasonable evidence of the probable filing of claims by Subcontractors, laborers, Material Suppliers, or others performing any portion of the Work under the Contract Documents for which the District may be liable or responsible including, without limitation, Stop Payment Notice Claims filed with the District pursuant to California Civil Code §9350 et seq.; (iv) a reasonable doubt that the Contract can be completed for the then unpaid balance of the Contract Price; (v) tax demands filed in accordance with California Government Code §12419.4; (vi) other claims, penalties and/or forfeitures for which the District is required or authorized to retain funds otherwise due the Contractor; (vii) any amounts due from the Contractor to the District under the terms of the Contract Documents; or (viii) the Contractor's failure to perform any of its obligations under the Contract Documents, its default under the Contract Documents or its failure to maintain adequate progress of the Work. In addition to the foregoing, the District shall not be obligated to process any Payment Application or Application for Final Payment, nor shall Contractor be entitled to any Progress Payment or Final Payment so long as any lawful or proper direction concerning the Work or the performance thereof or any portion thereof, given by the District, the District's Inspector, the Architect or any public authority having jurisdiction over the Work, or any portion thereof, shall not be fully and completely complied with by the Contractor. When the District is reasonably satisfied that the Contractor has remedied any such deficiency, payment shall be made of the amount withheld.

8.6 Payments to Subcontractors. The Contractor shall pay all Subcontractors for and on account of Work of the Contract performed by such Subcontractors in accordance with the terms of their respective subcontracts and as provided for pursuant to California Public Contract Code §10262, the provisions of which are deemed incorporated herein by this reference. If the Contractor fails to make payment to Subcontractors in conformity with California Public Contract Code §10262, the provisions of California Public Contract Code §10253 shall apply; by this reference, the provisions of California Public Contract Code §10253 are incorporated herein in its entirety, except that the references in said Section 10253 to "the director" shall be deemed to refer to the District. The Contractor shall timely make payment of retention due Subcontractors in accordance with Public Contract Code §7107.

8.7 Computerized Job Cost Reporting System.

8.7.1 Job Cost Reporting. The Contractor and each Subcontractor with a Subcontract valued at One Million Five Hundred Thousand Dollars ($1.5M) or greater shall maintain a computerized job cost reporting system conforming to the requirements set forth herein. The computer program(s) utilized by the Contractor and applicable Subcontractors shall be subject to the review and acceptance by the District. The job cost reporting systems for the Work shall be updated in regular intervals of not more than one (1) calendar month.

8.7.2 Job Cost Reporting System Requirements. The computerized job cost programs utilized by the Contractor and applicable Subcontractors shall conform and comply with generally accepted accounting principles applied in a consistent manner and with recognized and generally accepted construction industry accounting standards, guidelines and procedures. The job cost reporting system format and configuration shall follow the general format of the District approved Cost Breakdown and budgets established for each line item shall be traceable to a bid estimate of costs. The job cost reporting systems utilized by the Contractor and applicable Subcontractors shall be capable of: (i) providing overall cost status on a monthly and cumulative basis; (ii) providing comparative analysis of the original budgeted costs, actual costs, remaining budget, and projected cost of completion; the job cost reporting system shall be capable of providing comparative analysis for individual line items and the totality of the Work reflected in the job cost report and; (ii) tracking adjustments to original budget amounts for Changes to the Work (including, without limitation, issued, pending and potential Change Orders).

8.7.3 Job Cost System Information. Upon request of the District, the Contractor and applicable Subcontractors shall make available written job cost reports and/or provide the District with the electronic files of the then current or requested job cost report. The Contractor's obligations hereunder are material.

ARTICLE 9: CHANGES

9.1 Changes in the Work. The District, at any time, by written order, may make Changes within the general scope of the Work under the Contract Documents or issue additional instructions, require additional Work or direct deletion of Work. The Contractor shall not proceed with any Change involving an increase or decrease in the Contract Price or the Contract Time without prior written authorization from the District. The foregoing notwithstanding, the Contractor shall promptly commence and diligently complete any Change to the Work subject to the District's written authorization issued pursuant to the preceding sentence; the Contractor is not relieved or excused from its obligation to promptly commence and diligently complete any Change subject to the District's written authorization by virtue of the absence or inability of the Contractor and the District to agree upon the extent of any adjustment to the Contract Time or the Contract Price on account of such Change. The issuance of a Change Order pursuant to this Article 9 in connection with any Change authorized by the District under this Article 9.1 is not a condition precedent to Contractor's obligation to promptly commence and diligently complete any such Change authorized by the District hereunder. The District's right to make Changes shall not invalidate the Contract nor relieve the Contractor of any liability or other obligations under the Contract Documents. Any requirement of notice of Changes in the scope of Work to the Surety shall be the responsibility of the Contractor. Changes to the Work depicted or described in the Drawings or the Specifications shall be subject to approval by the DSA. The District may make Changes to bring the Work or the Project into compliance with environmental requirements or standards established by state or federal statutes and regulations enacted after award of the Contract.

9.2 Construction Change Directive. A Construction Change Directive is a written instrument issued by or on behalf of the District directing a Change to the Work prior to the Contractor and District reaching full agreement on an adjustment of the Contract Time and/or Contract Price on account of such Change. The Contractor shall promptly commence and diligently complete any Change to the Work subject to a Construction Change Directive issued hereunder. The issuance of a Change Order pursuant to this Article 9 in connection with any Construction Change Directive authorized by the District is not a condition precedent to Contractor's obligation to promptly commence and diligently complete any such Construction Change Directive. Upon completion of the Work subject to a Construction Change Directive, if the Contractor and District have not agreed on the

adjustment of Contract Time and/or Contract Price for such Change, District shall issue a Unilateral Change Order pursuant to this Article 9.

9.3 Oral Order of Change in the Work. Any oral order, direction, instruction, interpretation, or determination from the District or the Architect which in the opinion of the Contractor constitutes a Change to the Work, or otherwise requires an adjustment to the Contract Price or the Contract Time, shall be treated as a Change only if the Contractor gives the Architect, Project Manager, if any and the District's Inspector written notice within ten (10) days of the order, directions, instructions, interpretation or determination and prior to acting in accordance therewith. Time is of the essence in Contractor's written notice pursuant to the preceding sentence. Accordingly, Contractor acknowledges that its failure, for any reason, to give written notice within ten (10) days of such order, direction, instruction, interpretation or determination is the Contractor's waiver of any right to assert or claim any entitlement to an adjustment of the Contract Time or the Contract Price on account of such order, direction, instruction, interpretation or determination. The written notice shall state the date, circumstances, extent of adjustment to the Contract Price or the Contract Time, if any, requested, and the source of the order, directions, instructions, interpretation or determination that the Contractor regards as a Change. Unless the Contractor acts in strict accordance with this procedure, any such order, direction, instruction, interpretation or determination shall not be treated as a Change and the Contractor waives any claim for any adjustment to the Contract Price or the Contract Time on account thereof.

9.4 Contractor Submittal of Data. Within thirty (30) days after receipt of a written order directing a Change in the Work or furnishing the written notice regarding any oral order directing a Change in the Work, the Contractor shall submit to the Architect, Project Manager, if any, the District's Inspector and the District a detailed written statement setting forth the general nature of the Change, the adjustment to the Contract Price on account thereof, properly itemized and supported by sufficient substantiating data to permit evaluation of the same, and the extent of adjustment of the Contract Time, if any, required by such Change. No claim or adjustment to the Contract Price or the Contract Time shall be allowed if not asserted by the Contractor in strict conformity herewith or if asserted after Final Payment is made under the Contract Documents.

9.5 Adjustment to Contract Price and Contract Time on Account of Changes to the Work.

9.5.1 Adjustment to Contract Price. Adjustments to the Contract Price due to Changes in the Work shall be determined by application of one of the following methods, in the following order of priority:

9.5.1.1 Mutual Agreement. By negotiation and mutual agreement, on a lump sum basis, between the District and the Contractor on the basis of the estimate of the actual and direct increase or decrease in costs on account of the Change. Upon request of the District, Project Manager, if any, or the Architect, the Contractor shall provide a detailed estimate of increase or decrease in costs directly associated with performance of the Change along with cost breakdowns of the components of the Change and supporting data and documentation. The Contractor's estimate of increase or decrease in costs pursuant to the foregoing, if requested, shall be in sufficient detail and in such form as to allow the District, the District's Inspector and the Architect to review and assess the completeness and accuracy thereof. The Contractor shall be solely responsible for any additional costs or additional time arising out of, or related in any manner to, its failure to provide the estimate of costs within the time specified in the request of the District or the Architect for such estimate.

9.5.1.2 Determination by the District. By the District, whether or not negotiations are initiated pursuant to Article 9.5.1.1 above, based upon actual and necessary costs incurred by the Contractor as determined by the District on the basis of the Contractor's records. In the event that the procedure set forth in this Article 9.5.1.2 is utilized to determine the extent of adjustment to the Contract Price on account of Changes to the

Work, promptly upon determining the extent of adjustment to the Contract Price, the District shall notify the Contractor in writing of the same; the Contractor is deemed to have accepted the District's determination of the amount of adjustment to the Contract Price on account of a Change to the Work unless Contractor notifies the District, the Architect, Project Manager, if any and the District's Inspector, in writing, not more than fifteen (15) days from the date of the District's written notice, of any objection to the District's determination. Failure of the Contractor to timely notify the District, the Architect and the District's Inspector of Contractor's objections to the District's determination of the extent of adjustment to the Contract Price shall be deemed Contractor's acceptance of the District's determination and a waiver of any right or basis of the Contractor to thereafter protest or otherwise object to the District's determination. Notwithstanding any objection of the Contractor to the District's determination of the extent of any adjustment to the Contract Price pursuant to this Article 9.5.1.2, Contractor shall, pursuant to Article 9.8 below, diligently proceed to perform and complete any such Change.

9.5.1.3 Basis for Adjustment of Contract Price. If Changes in the Work require an adjustment of the Contract Price pursuant to Articles 9.5.1.1 or 9.5.1.2 above, the basis for adjustment of the Contract Price shall be as follows:

9.5.1.3.1 Labor. Contractor shall be compensated for the costs of labor actually and directly utilized in the performance of the Change. Such labor costs shall be limited to field labor for which there is a prevailing wage rate classification. Wage rates for labor shall not exceed the prevailing wage rates in the locality of the Site and shall be in the labor classification(s) necessary for the performance of the Change. Use of a labor classification which would increase labor costs associated with any Change shall not be permitted. Labor costs shall exclude costs incurred by the Contractor in preparing estimate(s) of the costs of the Change, in the maintenance of records relating to the costs of the Change, coordination and assembly of materials and information relating to the Change or performance thereof, or the supervision and other overhead and general conditions costs associated with the Change or performance thereof.

9.5.1.3.2 Materials and Equipment. Contractor shall be compensated for the costs of materials and equipment necessarily and actually used or consumed in connection with the performance of Changes. Costs of materials and equipment may include reasonable costs of transportation from a source closest to the site of the Work and delivery to the Site. If discounts by Material Suppliers are available for materials necessarily used in the performance of Changes, they shall be credited to the District. If materials and/or equipment necessarily used in the performance of Changes are obtained from a supplier or source owned in whole or in part by the Contractor, compensation therefor shall not exceed the current wholesale price for such materials or equipment. If, in the reasonable opinion of the District, the costs asserted by the Contractor for materials and/or equipment in connection with any Change is excessive, or if the Contractor fails to provide satisfactory evidence of the actual costs of such materials and/or equipment from its supplier or vendor of the same, the costs of such materials and/or equipment and the District's obligation for payment of the same shall be limited to the then lowest wholesale price at which similar materials and/or equipment are available in the quantities required to perform the Change. The District may elect to furnish materials and/or equipment for Changes to the Work, in which

event the Contractor shall not be compensated for the costs of furnishing such materials and/or equipment or any mark-up thereon.

9.5.1.3.3 Construction Equipment. Contractor shall be compensated for the actual cost of the necessary and direct use of Construction Equipment in the performance of Changes to the Work. Use of such Construction Equipment in the performance of Changes to the Work shall be compensated in increments of fifteen (15) minutes. Rental time for Construction Equipment moved by its own power shall include time required to move such Construction Equipment to the site of the Work from the nearest available rental source of the same. If Construction Equipment is not moved to the Site by its own power, Contractor will be compensated for the loading and transportation costs in lieu of rental time. The foregoing notwithstanding, neither moving time or loading and transportation time shall be allowed if the Construction Equipment is used for performance of any portion of the Work other than Changes to the Work. Unless prior approval in writing is obtained by the Contractor from the Architect, Project Manager, if any, the District's Inspector and the District, no costs or compensation shall be allowed for time while Construction Equipment is inoperative, idle or on standby, for any reason. The Contractor shall not be entitled to an allowance or any other compensation for Construction Equipment or tools used in the performance of Changes to the Work where such Construction Equipment or tools have a replacement value of $500.00 or less. Construction Equipment costs claimed by the Contractor in connection with the performance of any Change to the Work shall not exceed rental rates established by distributors or construction equipment rental agencies in the locality of the Site; any costs asserted which exceed such rental rates shall not be allowed or paid. Unless otherwise specifically approved in writing by the Architect, Project Manager, if any, the District's Inspector and the District, the allowable rate for the use of Construction Equipment in connection with Changes to the Work shall constitute full compensation to the Contractor for the cost of rental, fuel, power, oil, lubrication, supplies, necessary attachments, repairs or maintenance of any kind, depreciation, storage, insurance, labor (exclusive of labor costs of the Construction Equipment operator), and any all other costs incurred by the Contractor incidental to the use of such Construction Equipment.

9.5.1.3.4 Mark-up on Costs of Changes to the Work. In determining the cost to the District and the extent of increase to the Contract Price resulting from a Change adding to the Work, the allowance for mark-ups on the costs of the Change for all overhead (including home office and field overhead), general conditions costs and profit associated with the Change shall not exceed the percentage set forth in the Special Conditions, regardless of the number of Subcontractors, of any tier, performing any portion of any Change to the Work. If a Change to the Work reduces the Contract Price, no profit, general conditions or overhead costs shall be paid by the District to the Contractor for the reduced or deleted Work. In such event, the adjustment to the Contract Price shall be the actual cost reduction realized by the reduced or deleted Work multiplied by the percentage set forth in the Special Conditions for mark-ups on the cost of a Change adding to the scope of the Work.

9.5.1.4 Contractor Maintenance of Records. If the Contractor is directed to perform any Changes to the Work pursuant to Article 9.1, 9.2 or 9.3, or should the Contractor

encounter conditions which the Contractor believes to obligate the District to adjust the Contract Price and/or the Contract Time, Contractor shall maintain detailed records on a daily basis. Such records shall include without limitation hourly records for labor and Construction Equipment and itemized records of materials and equipment used that day in connection with the performance of any Change to the Work. If more than one Change to the Work is performed by the Contractor in a calendar day, Contractor shall maintain separate records of labor, Construction Equipment, materials and equipment for each such Change. If any Subcontractor provides or performs any portion of a Change to the Work, Contractor shall require that each such Subcontractor maintain records in accordance with this Article. Each daily record maintained hereunder shall be signed by Contractor's Superintendent or Contractor's authorized representative which shall constitute the Contractor's representation and warranty to the District that all information contained therein is true, accurate, complete and relate only to the Change referenced therein. All records maintained by a Subcontractor relating to the costs of a Change to the Work shall be signed by such Subcontractor's authorized representative or Superintendent. All records maintained hereunder shall be subject to inspection, review and/or reproduction by the District, the Architect, Project Manager, if any or the District's Inspector upon request. If the Contractor fails or refuses, for any reason, to maintain or make available for inspection, review and/or reproduction such records and the adjustment to the Contract Price on account of any Change to the Work, the District's reasonable good faith determination of the extent of adjustment to the Contract Price on account of such Change shall be final, conclusive, dispositive and binding upon Contractor. Contractor's obligation to maintain records hereunder is in addition to, and not in lieu of, any other Contractor obligation under the Contract Documents with respect to Changes to the Work.

9.5.2 Adjustment to Contract Time. If any Change to the Work authorized pursuant to this Article 9, the Contract Time affects the critical path of the Work, the Contract Time shall be extended or reduced by Change Order for a period of time commensurate with the time reasonably necessary to perform such Change. The Contractor is solely responsible for submitting scheduling data, analysis and other materials necessary or required by the District to substantiate the Contract Time adjustment requested by the Contractor for a Change. The District is not obligated to consider any adjustment to the Contract Time on account of a Change until the Contractor has submitted such scheduling data, analysis and other materials.

9.5.3 Addition or Deletion of Alternate Bid Item(s). If the Bid Proposal for the Work includes proposal(s) for Alternate Bid Item(s), during Contractor's performance of the Work, the District may elect, pursuant to this Article to add any such Alternate Bid Item(s) if the same did not form a basis for award of the Contract or delete any such Alternate Bid Item(s) if the same formed a basis for award of the Contract. If the District elects to add or delete any such Alternate Bid Item(s) pursuant to the foregoing, the cost or credit for such Alternate Bid Item(s) shall be as set forth in the Contractor's Bid. If any Alternate Bid Item is added or deleted from the Work pursuant to the foregoing, the Contract Time shall be adjusted by the number of days allocated for the added or deleted Alternate Bid Item in the Contract Documents; if days are not allocated for any Alternate Bid Item added or deleted pursuant to the foregoing, the Contract Time shall be equitably adjusted.

9.6 Change Orders. If the District approves of a Change, a written Change Order prepared by the Architect on behalf of the District shall be forwarded to the Contractor describing the Change and setting forth the adjustment to the Contract Time and the Contract Price, if any, on account of such Change. All Change Orders shall be in full payment and final settlement of all claims for direct, indirect and consequential costs, including without limitation, costs of delays or impacts related to, or arising out of, items covered and affected by the Change Order, as well as any adjustments to the Contract Time. Any claim or item relating to any Change incorporated into a Change Order not

presented by the Contractor for inclusion in the Change Order shall be deemed waived. The Contractor shall execute the Change Order prepared pursuant to the foregoing; once the Change Order has been prepared and forwarded to the Contractor for execution, without the prior approval of the District which may be granted or withheld in the sole and exclusive discretion of the District, the Contractor shall not modify or amend the form or content of such Change Order, or any portion thereof. The Contractor's attempted or purported modification or amendment of any such Change Order, without the prior approval of the District, shall not be binding upon the District; any such unapproved modification or amendment to such Change Order shall be null, void and unenforceable. Unless otherwise expressly provided for in the Contract Documents or in the Change Order, any Change Order issued hereunder shall be binding upon the District only upon action of the District's Board of Trustees approving and ratifying such Change Order. In the event of any amendment or modification made by the Contractor to a Change Order for which there is no prior approval by the District, in accordance with the provisions of this Article 9.6, unless otherwise expressly stated in its approval and ratification of such Change Order, any action of the Board of Trustees to approve and ratify such Change Order shall be deemed to be limited to the Change Order as prepared by the Architect; such approval and ratification of such Change Order shall not be deemed the District's approval and ratification of any unapproved amendment or modification by the Contractor to such Change Order.

9.7 Contractor Notice of Changes. If the Contractor claims that any instruction, request, the Drawings, the Specifications, action, condition, omission, default, or other situation obligates the District to increase the Contract Price or to extend the Contract Time, the Contractor shall notify the Project Manager, if any, the District's Inspector and the Architect, in writing, of such claim within ten (10) days from the date of its actual or constructive notice of the factual basis supporting the same. The District shall consider any such claim of the Contractor only if sufficient supporting documentation is submitted with the Contractor's notice to the District's Inspector and the Architect. Time is of the essence in Contractor's written notice pursuant to the preceding sentence so that the District can promptly investigate and consider alternative measures to the address such instruction, request, Drawings, Specifications, action, condition, omission, default or other situation. Accordingly, Contractor acknowledges that its failure, for any reason, to give written notice (with sufficient supporting documentation to permit the District's review and evaluation) within ten (10) days of its actual or constructive knowledge of any instruction, request, Drawings, Specifications, action, condition, omission, default or other situation for which the Contractor believes there should an adjustment of the Contract Time or the Contract Price shall be deemed Contractor's waiver, release, discharge and relinquishment of any right to assert or claim any entitlement to an adjustment of the Contract Time or the Contract Price on account of any such instruction, request, Drawings, Specifications, action, condition, omission, default or other situation. In the event that the District determines that the Contract Price or the Contract Time are subject to adjustment based upon the events, circumstances and supporting documentation submitted with the Contractor's written notice under this Article 9.7, any such adjustment shall be determined in accordance with the provisions of Articles 9.5.1 and 9.5.2.

9.8 Disputed Changes. If there is any dispute or disagreement between the Contractor and the District or the Architect regarding the characterization of any item as a Change to the Work or as to the appropriate adjustment of the Contract Price or the Contract Time on account thereof, the Contractor shall promptly proceed with the performance of such item of the Work, subject to a subsequent resolution of such dispute or disagreement in accordance with the terms of the Contract Documents. The Contractor's failure or refusal to so proceed with such Work may be deemed to be Contractor's default of a material obligation of the Contractor under the Contract Documents.

9.9 Emergencies. In an emergency affecting or threatening the safety of persons, or which affects or threatens the Work, or property, the Contractor, without special instruction or prior authorization from the District, Project Manager or the Architect, is permitted to act at its discretion to prevent

such threatened loss or injury. Any compensation claimed by the Contractor on account of such emergency work shall be submitted and determined in accordance with this Article 9.

9.10 Minor Changes in the Work. The Architect may order minor Changes in the Work not involving an adjustment in the Contract Price or the Contract Time and not inconsistent with the intent of the Contract Documents. Such Changes shall be effected by written order and shall be binding on the District and the Contractor. The Contractor shall carry out such orders promptly.

9.11 Unauthorized Changes. Any Work beyond the lines and grades shown on the Contract Documents, or any extra Work performed or provided by the Contractor without notice to the Architect and the District's Inspector in the manner and within the time set forth in Articles 9.2 or 9.7 shall be considered unauthorized and at the sole expense of the Contractor. Work so done will not be measured or paid for, no extension to the Contract Time will be granted on account thereof and any such Work may be ordered removed at the Contractor's sole cost and expense. The failure of the District to direct or order removal of such Work shall not constitute acceptance or approval of such Work nor relieve the Contractor from any liability on account thereof.

ARTICLE 10: SEPARATE CONTRACTORS

10.1 District's Right to Award Separate Contracts. The District reserves the right to perform construction or operations related to the Project with the District's own forces or to award separate contracts in connection with other portions of the Project or other construction or operations at or about the Site. If the Contractor claims that delay or additional cost is involved because of such action by the District, the Contractor shall seek an adjustment to the Contract Price or the Contract Time as provided for in the Contract Documents. Failure of the Contractor to request such an adjustment of the Contract Time or the Contract Price in strict conformity with the provisions of the Contract Documents applicable thereto shall be deemed a waiver of the same.

10.2 District's Coordination of Separate Contractors. The District shall provide for coordination of the activities of the District's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the District in reviewing their respective Construction Schedules when directed to do so. The Contractor shall make any revisions to the Approved Construction Schedule for the Work hereunder deemed necessary after a joint review and mutual agreement. The Construction Schedules shall then constitute the Construction Schedules to be used by the Contractor, separate contractors and the District until subsequently revised.

10.3 Mutual Responsibility. The Contractor shall afford the District and separate contractors of the District reasonable opportunity for storage of their materials and equipment and performance of their activities at the Site and shall connect and coordinate the Contractor's Work, construction and operations with theirs as required by the Contract Documents.

10.4 Discrepancies or Defects. If part of the Contractor's Work depends for proper execution or results upon construction or operations by the District or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect, Project Manager, if any and the District's Inspector any apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor to so report shall constitute an acknowledgment that the District's or separate contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then discoverable by the Contractor's reasonable diligence.

ARTICLE 11: TESTS AND INSPECTIONS

11.1 Tests; Inspections; Observations.

11.1.1 Contractor's Notice. If the Contract Documents, the Laws or any public authority with jurisdiction over the Work requires the Work, or any portion thereof, to be specially tested, inspected or approved, the Contractor shall give the Architect, the Project Manager and the

District's Inspector written notice of the readiness of such Work for observation, testing or inspection at least two (2) working days prior to the time for the conducting of such test, inspection or observation. The Contractor shall not cover up any portion of the Work subject to tests, inspections or observations prior to the completion and satisfaction of the requirements of such test, inspection or observation. If any portion of the Work subject to tests, inspection or approval is covered up by Contractor prior to completion and satisfaction of the requirements of such tests, inspection or approval, Contractor shall be responsible for the uncovering of such portion of the Work as is necessary for performing such tests, inspection or approval without adjustment of the Contract Price or the Contract Time on account thereof.

11.1.2 Cost of Tests and Inspections. The District will pay for fees, costs and expenses for the initial tests/inspections of materials/equipment which are conducted at the Site or locations within a one hundred (100) mile radius of the Site. All fees, costs or expenses for subsequent tests/inspections or for tests/inspections conducted at a location more than a one hundred (100) mile radius from the Site (including without limitation, travel and travel-related expenses) shall be borne solely and exclusively by the Contractor.

11.1.3 Testing/Inspection Laboratory. The District shall select duly qualified person(s) or testing laboratory(ies) to conduct the tests and inspections to be paid for by the District and required by the Contract Documents. All such tests and inspections shall be in conformity with the Laws, including without limitation, Title 24 of the California Code of Regulations. Where inspection or testing is to be conducted by an independent laboratory or testing agency, materials or samples thereof shall be selected by the laboratory, testing agency, the District's Inspector, the Project Manager or the Architect and not by the Contractor.

11.1.4 Additional Tests, Inspections and Approvals. If the Architect, the Project Manager, the District's Inspector or public authorities having jurisdiction over the Work determine that portions of the Work require additional testing, inspection or approval, the Architect or Project Manager, if any will, upon written authorization from the District, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the District, and the Contractor shall give timely notice to the Architect, the Project Manager and the District's Inspector of when and where tests and inspections are to be made so the District's Inspector and the Architect may observe such procedures. The District shall bear the costs of such additional tests, inspections or approvals, except to the extent that such additional tests, inspections or approvals reveal any failure of the Work to comply with the requirements of the Contract Documents, in which case the Contractor shall bear all costs made necessary by such failures, including without limitation, the costs of corrections, repeat tests, inspections or approvals and the fees of the Architect, Project Manager, if any, and the District's Inspector in connection therewith.

11.2 Delivery of Certificates. Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

11.3 Timeliness of Tests, Inspections and Approvals. Tests or inspections required and conducted pursuant to the Contract Documents shall be made or arranged by Contractor to avoid delay in the progress of the Work.

ARTICLE 12: UNCOVERING AND CORRECTION OF WORK

12.1 Inspection of the Work.

12.1.1 Access to the Work. All Work and all materials and equipment forming a part of the Work or incorporated into the Work are subject to inspection by the District, the Project Manager, the Architect and the District's Inspector for conformity with the Contract Documents. The Contractor shall, at its cost and without adjustment to the Contract Price or the Contract Time, furnish any facilities necessary for sufficient and safe access to the Work for purposes of inspection by the District, the Project Manager, the Architect, the District's Inspector, DSA or

any other public or quasi-public authority with jurisdiction over the Work or any portion thereof.

12.1.2 Limitations Upon Inspections. Inspections, tests, measurements, or other acts of the Architect and the District's Inspector hereunder are for the sole purpose of assisting them in determining that the Work, materials, equipment, progress of the Work, and quantities generally comply and conform with the requirements of the Contract Documents. These acts or functions shall not relieve the Contractor from performing the Work in full compliance with the Contract Documents. No inspection by the Architect or the District's Inspector shall constitute or imply acceptance of Work inspected. Inspection of the Work hereunder is in addition to, and not in lieu of, any other testing, inspections or approvals of the Work required under the Contract Documents.

12.2 Uncovering of Work. If any portion of the Work is covered contrary to the request of the Architect, the District's Inspector or the requirements of the Contract Documents, it must, if required by the Architect or the District's Inspector, be uncovered for observation by the Architect and the District's Inspector and be replaced at the Contractor's expense without adjustment of the Contract Time or the Contract Price.

12.3 Rejection of Work. Prior to the District's Final Acceptance of the Work, any Work or materials or equipment forming a part of the Work or incorporated into the Work which is defective or not in conformity with the Contract Documents may be rejected by the District, the Project Manager the Architect or the District's Inspector and the Contractor shall correct such rejected Work without any adjustment to the Contract Price or the Contract Time, even if the Work, materials or equipment have been previously inspected by the Architect or the District's Inspector or even if they failed to observe the defective or non-conforming Work, materials or equipment.

12.4 Correction of Work. The Contractor shall promptly correct any portion of the Work rejected by the District, the Project Manager, the Architect or the District's Inspector for failing to conform to the requirements of the Contract Documents, or which is determined by them to be defective, whether observed before or after Completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such rejected Work, including additional testing and inspections and compensation for the Architect's services and expenses made necessary thereby. The Contractor shall bear all costs of correcting destroyed or damaged construction, whether completed or partially completed, of the District or separate contractors, caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents, or which is defective.

12.5 Removal of Non-Conforming or Defective Work. The Contractor shall, at its sole cost and expense, remove from the Site all portions of the Work which are defective or are not in accordance with the requirements of the Contract Documents which are neither corrected by the Contractor nor accepted by the District.

12.6 Failure of Contractor to Correct Work. If the Contractor fails to commence to correct defective or non-conforming Work within three (3) days of notice of such condition and promptly thereafter complete the same within a reasonable time, the District may correct it in accordance with the Contract Documents. If the Contractor does not proceed with correction of such defective or non-conforming Work within the time fixed herein, the District may remove it and store the salvable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage after written notice, the District may sell such materials or equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including without limitation compensation for the Architect's services, attorneys fees and other expenses made necessary thereby. If such proceeds of sale do not cover costs which the Contractor should have borne, the Contract Price shall be reduced by the deficiency. If payments of the Contract Price then or thereafter due the Contractor

are not sufficient to cover such amount, the Contractor and the Surety shall be jointly and severally liable to the District for any such excess amount.

12.7 Acceptance of Defective or Non-Conforming Work. The District may, in its sole and exclusive discretion, elect to accept Work which is defective or which is not in accordance with the requirements of the Contract Documents, instead of requiring its removal and correction, in which case the Contract Price shall be reduced as appropriate and equitable. The District's determination of the extent of reduction of the Contract Price on account of defective or non-conforming Work accepted by the District shall be binding, conclusive, dispositive and not subject to appeal or other dispute resolution procedures, unless such determination is manifestly unreasonable.

ARTICLE 13: WARRANTIES

13.1 Workmanship and Materials. The Contractor warrants to the District that: (i) all materials and equipment furnished under the Contract Documents conform to requirements of the Contract Documents and are new, of good quality and of the most suitable grade and quality for the purpose intended, unless otherwise specified in the Contract Documents; and (ii) all Work and workmanship is of good quality, free from faults and defects and in conformity with the requirements of the Contract Documents. If required by the Architect or the District, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment incorporated into the Work. Any Work or portion thereof not conforming to these requirements, including substitutions or alternatives not properly approved in accordance with the Contract Documents may be deemed defective. Where there is an approved substitution of, or alternative to, material or equipment specified in the Contract Documents, the Contractor warrants to the District that such installation, construction, material, or equipment will equally perform the function and have the quality of the originally specified material or equipment. The Contractor expressly warrants the merchantability, the fitness for use, and quality of all substitute or alternative items in addition to any warranty given by the manufacturer or supplier of such item.

13.2 Warranty Work. If, within one (1) year after the date of Final Acceptance, or such other time frame set forth elsewhere in the Contract Documents, any of the Work is found to be defective or not in accordance with the requirements of the Contract Documents, or otherwise contrary to the warranties contained in the Contract Documents, the Contractor shall commence all necessary corrective action not more than seven (7) days after receipt of a written notice from the District to do so, and to thereafter diligently complete the same. In the event that Contractor shall fail or refuse to commence correction of any such item within said seven (7) day period or to diligently prosecute such corrective actions to completion, the District may, without further notice to Contractor, cause such corrective Work to be performed and completed. In such event, Contractor and Contractor's Performance Bond Surety shall be responsible for all costs in connection with such corrective Work, including without limitation, general administrative overhead costs of the District in securing and overseeing such corrective Work. Nothing contained herein shall be construed to establish a period of limitation with respect to any obligation of the Contractor under the Contract Documents. The obligations of the Contractor hereunder shall be in addition to, and not in lieu of, any other obligations imposed by any special guarantee or warranty required by the Contract Documents, guarantees or warranties provided by any manufacturer of any item or equipment forming a part of, or incorporated into the Work, or otherwise recognized, prescribed or imposed by law. Neither the District's Final Acceptance, the making of Final Payment, any provision in Contract Documents, nor the use or occupancy of the Work, in whole or in part, by District shall constitute acceptance of Work not in accordance with the Contract Documents nor relieve the Contractor or the Contractor's Performance Bond Surety from liability with respect to any warranties or responsibility for faulty or defective Work or materials, equipment and workmanship incorporated therein.

13.3 Guarantee. Upon completion of the Work, Contractor shall execute and deliver to the District the form of Guarantee included with the Contract Documents. The Contractor's execution and delivery

of the form of Guarantee is an express condition precedent to any obligation of the District to disburse the Final Payment to the Contractor.

13.4 Survival of Warranties; Surety Obligations. The Contractor's warranty obligations hereunder shall survive the Contractor's completion of Work under the Contract Documents, the District's Final Acceptance or the termination of the Contract. The obligations of the Surety issuing the Performance Bond shall include assumption and discharge of the Contractor's warranty obligations if the Contractor fails or refuses to perform its warranty obligations hereunder in strict conformity herewith.

ARTICLE 14: SUSPENSION OF WORK

14.1 District's Right to Suspend Work. The District may, without cause, and without invalidating or terminating the Contract, order the Contractor, in writing, to suspend, delay or interrupt the Work in whole or in part for such period of time as the District may determine. The Contractor shall resume and complete the Work suspended by the District in accordance with the District's directive, whether issued at the time of the directive suspending the Work or subsequent thereto.

14.2 Adjustments to Contract Price and Contract Time. If the District directs suspension of the Work, an adjustment shall be made to the Contract Price for increases in the direct cost of performance of the Work of the Contract Documents, actually caused by suspension, delay or interruption ordered by the District; provided however that no adjustment of the Contract Price shall be made to the extent: (i) that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible under the Contract Documents; or (ii) that an equitable adjustment is made or denied under another provision of the Contract Documents. The foregoing notwithstanding, any such adjustment of the Contract Price shall not include any adjustment to increase the Contractor's overhead, general administrative costs or profit, all of which will remain as reflected in the Cost Breakdown submitted by the Contractor pursuant to the Contract Documents. In the event of the District's suspension of the Work, the Contract Time shall be equitably adjusted.

ARTICLE 15: TERMINATION

15.1 Termination for Cause.

15.1.1 District's Right to Terminate. The District may terminate the Contract upon the occurrence of any one or more of the following events of the Contractor's default: (i) if the Contractor refuses or fails to prosecute the Work with diligence as will insure Completion of the Work within the Contract Time, or if the Contractor fails to One Hundred Percent Complete the Work within the Contract Time; (ii) if the Contractor becomes bankrupt or insolvent, or makes a general assignment for the benefit of creditors, or if the Contractor or a third party files a petition to reorganize or for protection under any bankruptcy or similar laws, or if a trustee or receiver is appointed for the Contractor or for any of the Contractor's property on account of the Contractor's insolvency, and the Contractor or its successor in interest does not provide adequate assurance of future performance in accordance with the Contract Documents within ten (10) days of receipt of a request for such assurance from the District; (iii) if the Contractor repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment; (iv) if the Contractor repeatedly fails to make prompt payments to any Subcontractor, of any tier, or Material Suppliers or others for labor, materials or equipment; (v) if the Contractor disregards laws, ordinances, rules, codes, regulations, orders applicable to the Work or similar requirements of any public entity having jurisdiction over the Work; (iv) if the Contractor disregards proper directives of the Architect, the District's Inspector or District under the Contract Documents; (vii) if the Contractor performs Work which deviates from the Contract Documents and neglects or refuses to correct such Work; or (viii) if the Contractor otherwise violates in any material way any provisions or requirements of the

Contract Documents. Once the District determines that sufficient cause exists to justify the action, the District may terminate the Contract without prejudice to any other right or remedy the District may have, after giving the Contractor and the Surety at least seven (7) days advance written notice of the effective date of termination. The District shall have the sole discretion to permit the Contractor to remedy the cause for the termination without waiving the District's right to terminate the Contract, or otherwise waiving, restricting or limiting any other right or remedy of the District under the Contract Documents or at law.

15.1.2 District's Rights Upon Termination. If the Contract is terminated pursuant to this Article 15.1, the District may take over the Work and prosecute it to completion, by contract or otherwise, and may exclude the Contractor from the site. The District may take possession of the Work and of all of the Contractor's tools, appliances, construction equipment, machinery, materials, and plant which may be on or about the Site, and use the same to the full extent they could be used by the Contractor without liability to the Contractor. In exercising the District's right to prosecute the completion of the Work, the District may also take possession of all materials and equipment at or about the Site or for which the District has paid the Contractor but which are stored elsewhere, and finish the Work as the District deems expedient. In exercising the District's right to prosecute the completion of the Work, the District shall have the right to exercise its sole discretion as to the manner, methods, and reasonableness of the costs of completing the Work and the District shall not be required to obtain the lowest price for completion of the Work. If the District takes bids for remedial Work or completion of the Work, the Contractor shall not be eligible for the award of such contract(s).

15.1.3 Completion by the Surety. If the Contract is terminated pursuant to this Article 15.1, the District may demand that the Surety take over and complete the Work. The District may require that in so doing, the Surety not utilize the Contractor in performing and completing the Work. Upon the failure or refusal of the Surety to take over and begin completion of the Work within twenty (20) days after demand therefor, the District may take over the Work and prosecute it to completion as provided for above.

15.1.4 Assignment and Assumption of Subcontracts. The District shall, in its sole and exclusive discretion, have the option of requiring any Subcontractor or Material Supplier to perform in accordance with its Subcontract or Purchase Order with the Contractor and assign the Subcontract or Purchase Order to the District or such other person or entity selected by the District to complete the Work.

15.1.5 Costs of Completion. In the event of termination under this Article 15.1, the Contractor shall not be entitled to receive any further payment of the Contract Price until the Work is completed. If the unpaid balance of the Contract Price as of the date of termination exceeds the District's direct and indirect costs and expenses for completing the Work, including without limitation, attorneys' fees, fees for additional professional and consultant services, and the District's administrative costs, such excess shall be used to pay the Contractor for the cost of the Work performed prior to the effective date of termination with a reasonable allowance for overhead and profit. If the District's costs and expenses to complete the Work exceed the unpaid Contract Price, the Contractor and Surety are jointly and severally liable for payment of such difference to the District.

15.1.6 Contractor Responsibility for Damages. The Contractor and the Surety shall be jointly and severally liable for all damage sustained by the District resulting from, in any manner, the termination of Contract under this Article 15.1, including without limitation, attorneys' fees, and for all costs necessary for repair and completion of the Work exceeding the Contract Price.

15.1.7 Conversion to Termination for Convenience. In the event the Contract is terminated under this Article 15.1, and it is determined, for any reason, that the Contractor was not in default under the provisions hereof, the termination shall be deemed a Termination for Convenience of the District and thereupon, the rights and obligations of

the District and the Contractor shall be determined in accordance with Article 15.2 hereof.

15.1.8 District's Rights Cumulative. In the event the Contract is terminated pursuant to this Article 15.1, the termination shall not affect or limit any rights or remedies of the District against the Contractor or the Surety. The rights and remedies of the District under this Article 15.1 are in addition to, and not in lieu of, any other rights and remedies provided by the Laws or under the Contract Documents. Any retention or payment of monies to the Contractor by the District shall not be deemed to release the Contractor or the Surety from any liability hereunder.

15.2 Termination for Convenience of the District. The District may at any time, in its sole and exclusive discretion, by written notice to the Contractor, terminate the Contract in whole or in part when it is in the interest of, or for the convenience of, the District. In such case, the Contractor shall be entitled to payment for: (i) Work actually performed and in place as of the effective date of such termination for convenience of the District, with a reasonable allowance for profit and overhead on such Work, and (ii) reasonable termination expenses for reasonable protection of Work in place and suitable storage and protection of materials and equipment delivered to the site of the Work but not yet incorporated into the Work, provided that such payments exclusive of termination expenses shall not exceed the total Contract Price as reduced by payments previously made to the Contractor and as further reduced by the value of the Work as not yet completed. The Contractor shall not be entitled to profit and overhead on Work which was not performed as of the effective date of the termination for convenience of the District. The District may, in its sole discretion, elect to have Subcontracts assigned pursuant to Article 15.1.4 above after exercising the right hereunder to terminate for the District's convenience.

ARTICLE 16: MISCELLANEOUS

16.1 Governing Law. This Contract shall be governed by and interpreted in accordance with the laws of the State of California.

16.2 Marginal Headings; Interpretation. The titles of the various Articles of these General Conditions and elsewhere in the Contract Documents are used for convenience of reference only and are not intended to, and shall in no way, enlarge or diminish the rights or obligations of the District or the Contractor and shall have no effect upon the construction or interpretation of the Contract Documents. The Contract Documents shall be construed as a whole in accordance with their fair meaning and not strictly for or against the District or the Contractor.

16.3 Successors and Assigns. Except as otherwise expressly provided in the Contract Documents, all terms, conditions and covenants of the Contract Documents shall be binding upon, and shall inure to the benefit of the District and the Contractor and their respective heirs, representatives, successors-in-interest and assigns.

16.4 Cumulative Rights and Remedies; No Waiver. Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not in lieu of or otherwise a limitation or restriction of duties, obligations, rights and remedies otherwise imposed or available by law. No action or failure to act by the District shall constitute a waiver of a right or remedy afforded it under the Contract Documents or at law nor shall such an action or failure to act constitute approval of or acquiescence in a breach hereunder, except as may be specifically agreed in writing.

16.5 Severability. In the event any provision of the Contract Documents shall be deemed illegal, invalid, unenforceable and/or void, by a court or any other governmental agency of competent jurisdiction, such provision shall be deemed to be severed and deleted from the Contract Documents, but all remaining provisions hereof, shall in all other respects, continue in full force and effect.

16.6 No Assignment by Contractor. The Contractor shall not sublet or assign the Contract, or any portion thereof, or any monies due thereunder, without the express prior written consent and approval of the District, which approval may be withheld in the sole and exclusive discretion of the District. The District's approval to such assignment shall be upon such terms and conditions as determined by the District in its sole and exclusive discretion.

16.7 Gender and Number. Whenever the context of the Contract Documents so require, the neuter gender shall include the feminine and masculine, the masculine gender shall include the feminine and neuter, the singular number shall include the plural and the plural number shall include the singular.

16.8 Independent Contractor Status. In performing its obligations under the Contract Documents, the Contractor is an independent contractor to the District and not an agent or employee of the District.

16.9 Notices. Except as otherwise expressly provided for in the Contract Documents, all notices which the District or the Contractor may be required, or may desire, to serve on the other, shall be effective only if delivered by personal delivery or by postage prepaid, First Class Certified Return Receipt Requested United States Mail, addressed to the District or the Contractor at their respective address set forth in the Contract Documents, or such other address(es) as either the District or the Contractor may designate from time to time by written notice to the other in conformity with the provisions hereof. In the event of personal delivery, such notices shall be deemed effective upon delivery, provided that such personal delivery requires a signed receipt by the recipient acknowledging delivery of the same. In the event of mailed notices, such notice shall be deemed effective on the third working day after deposit in the mail.

16.10 Disputes; Continuation of Work. Notwithstanding any claim, dispute or other disagreement between the District and the Contractor regarding performance under the Contract Documents, the scope of Work thereunder, or any other matter arising out of or related to, in any manner, the Contract Documents, the Contractor shall proceed diligently with performance of the Work in accordance with the District's written direction, pending any final determination or decision regarding any such claim, dispute or disagreement.

16.11 Dispute/Claims Resolution.

16.11.1 Public Contract Code §9204 Claims Resolution Procedures. Claims of the Contractor are subject to the non-binding dispute resolution procedures set forth in Public Contract Code §9204 ("Section 9204") provided, however, that the Contractor's initiation of Section 9204 procedures is expressly subject to the Contractor's prior full and timely compliance with requirements and procedures of the Contract Documents relating to procedures for resolution of claims, change orders, disputes and other matters in controversy under the Contract Documents.

16.11.1.1 Claim Defined. The term "Claim" shall be as defined in Section 9204.

16.11.1.2 Claim Documentation. The Contractor shall furnish reasonable documentation to support each Claim. "Reasonable documentation" includes, without limitation: (i) contractual and legal basis establishing Claim entitlement or merit; (ii) factual basis establishing District liability for the Claim; (iii) detailed breakdown of labor, materials, equipment and other costs included in the Claim; and (iv) detailed basis, including Construction Schedule analysis and fragnets supporting any Contract Time adjustment or Liquidated Damages relief included in the scope of a Claim.

16.11.1.3 District Claim Review Statement. Within forty five (45) days (or such other time mutually agreed to by the District and the Contractor) after receipt of a properly submitted and properly documented Claim, the District will conduct a reasonable review

of the Claim and provide the Contractor with a written statement identifying the disputed and undisputed portions of the Claim ("Claim Review Statement"). If the District does not provide the Contractor with the Claim Review Statement for any Claim within forty five (45) days (or other time mutually agreed to by the District and the Contractor) after receipt of a properly submitted and properly documented Claim, the Claim is deemed rejected in its entirety and thereupon, the Contractor may initiate the Meet and Confer process described below. A Claim deemed rejected pursuant to the foregoing does not constitute an adverse finding of Claim merit or the Contractor's responsibility or qualifications. If the Claim Review Statement identifies any undisputed portion of a Claim ("Undisputed Claim") and payment is due from the District on the Undisputed Claim, the District shall process and make payment on the Undisputed Claim within sixty (60) days after the issuance date of the Claim Review Statement.

16.11.1.4 Meet and Confer.

16.11.1.4.1 Meet and Confer Demand. If the Contractor disputes any portion of the Claim Review Statement, or if a Claim is deemed rejected by the District not providing the Contractor with the Claim Review Statement within the time permitted under Section 9204, the Contractor may demand an informal conference to meet and confer with the District for settlement of the issues in dispute ("Meet and Confer"). The Contractor's Meet and Confer request must be submitted to the District: (i) in writing; (ii) by registered mail or certified mail, return receipt requested; and (iii) within ten (10) days after the Claim Review Statement is submitted to the Contractor or within ten (10) days after the date the Claim is deemed rejected, as applicable. Failure of the Contractor to strictly comply with the foregoing is deemed a waiver of the Contractor's right to request the Meet and Confer and the Non-Binding Mediation procedures under Section 9204. If the Contractor strictly complies with the foregoing, the District will schedule the Meet and Confer conference within thirty (30) days of the Contractor's Meet and Confer request for settlement of disputed portions of the Claim Review Statement.

16.11.1.4.2 Meet and Confer Statement. Within ten (10) business days after conclusion of the Meet and Confer conference, if any portion of a Claim remains disputed, the District shall provide the Contractor a written statement identifying the disputed and undisputed portions of the Claim ("Meet and Confer Statement"). If the Meet and Confer Statement identifies any Undisputed Claim and payment is due from the District on the Undisputed Claim, the District shall process and make payment on the Undisputed Claim within sixty (60) days after date the Meet and Confer Statement is issued.

16.11.1.5 Non-Binding Mediation.

16.11.1.5.1 Contractor Initiation. The Contractor may request nonbinding mediation ("Mediation") of disputed portions of a Claim identified in the Meet and Confer Statement. The Contractor's Mediation demand must be submitted to the District: (i) in writing; (ii) by registered mail or certified mail, return receipt requested; (iii) within ten (10) days after the Meet and Confer Statement is submitted to the Contractor; and (iv) with specific identification of the disputed Claims issues subject to Mediation. Failure of the Contractor to strictly comply with the foregoing is deemed a waiver of the Contractor's right to demand Mediation procedures under Section 9204.

16.11.1.5.2 Mediator Selection. The District and Contractor shall mutually agree to a mediator within ten (10) business days after the date of the Contractor's demand for Mediation. If the District and Contractor do not mutually agree to a mediator, the District and Contractor shall each select a mediator and the District/Contractor selected mediators shall select a qualified neutral third party to mediate the disputed portion of the Claim.

16.11.1.5.3 Mediation Procedures. Mediation includes any nonbinding process, including, but not limited to, neutral evaluation or a dispute review board, in which an independent third party or board assists the District and Contractor in dispute resolution through negotiation or by issuance of an evaluation.

16.11.1.5.4 Mediation Costs. All costs, fees and expenses of the mediator(s) and mediation administration shall be shared equally by the District and Contractor. The foregoing notwithstanding, the Contractor and District shall each bear the costs, fees and expenses of their own attorneys, experts and consultants.

16.11.1.5.5 Post-Mediation Disputed Claims. Any Claims issues in dispute after Mediation shall be resolved in accordance with the applicable provisions of the Contract Documents.

16.11.1.5.6 Waiver. The District and Contractor may mutually agree to waive, in writing, Mediation under Section 9204 and subject to the Contractor's compliance with Government Code Claim requirements, proceed directly to commencement of a civil action or binding arbitration.

16.11.2 Payments of Undisputed Claims. If a payment due from the District for Undisputed Claims identified in the Claim Review Statement or the Meet and Confer Statement issued for a Claim is not made within the time established under Section 9204 the overdue portion of such payment shall bear interest at the rate of seven percent (7%) per annum from the date due. The District's credit application of any amount due for an Undisputed Claim against amounts due from the Contractor under the Contract Documents shall be deemed payment of the Undisputed Claim.

16.11.3 Subcontractor Claims.

16.11.3.1 Subcontractor Claim Submittal. If a Subcontractor, of any tier (collectively "Subcontractor") lacks legal standing to assert a Claim against the District because privity of contract does not exist, the Contractor may present the District a Claim on behalf of the Subcontractor ("Subcontractor Claim"). Each Subcontractor requesting submittal of a Subcontractor Claim to the District shall furnish reasonable documentation to support the Subcontractor Claim. Within forty-five (45) days of receipt of a Subcontractor's written request to submit a Subcontractor Claim, the Contractor shall notify the Subcontractor in writing as to whether the Contractor presented the Subcontractor Claim to the District. If the Contractor did not present the Subcontractor Claim, the Contractor shall provide the Subcontractor with a statement of the reasons for not having done so.

16.11.3.2 Contractor Certification of Subcontractor Claim. The District's review of Subcontractor Claims is expressly subject to the Contractor's submittal of a duly completed and executed form of Contractor Certification of Subcontractor Claim certifying that the Contractor has thoroughly reviewed the Subcontractor Claim and based on the Contractor's review, certify that: (i) the Subcontractor Claim is made by the Subcontractor in good faith; (ii) the Subcontractor Claim is supported by reasonable

documentation establishing entitlement to the relief requested and District liability therefor; and (iii) the Subcontractor Claim does not incorporate any request constituting a False Claim under applicable law, including the California False Claim Act (Government Code §12650 et seq). The form of Contractor Certification of Subcontractor Claim is included in the Contract Documents.

16.11.3.3 District Review of Subcontractor Claim. Subcontractor Claims presented by the Contractor to the District are subject to the Section 9204 non-binding dispute resolution procedures set forth above, as modified herein. Requests for the District to conduct Meet and Confer and/or non-binding mediation procedures must be submitted jointly by the Contractor and the Subcontractor submitting the Subcontractor Claim. If Mediation proceedings are initiated in connection with a Subcontractor Claim, mediator and mediation administration fees and costs shall be borne equally by the District, Contractor and Subcontractor.

16.11.3.4 Disputed Subcontractor Claims. Subcontractor Claims which are not fully resolved by the Section 9204 non-binding dispute resolution procedures shall be resolved by Section 20104.4 Dispute Resolution Procedures or binding arbitration, as applicable. Commencement of Section 20104.4 Dispute Resolution Procedures or binding arbitration proceedings in connection with any Subcontractor Claim is subject to compliance with Government Code Claims requirements.

16.11.4 Government Code Claim Requirements. Pursuant to Government Code §930.6, any claim, demand, dispute, disagreement or other matter in controversy asserted by the Contractor, whether on behalf of itself or a Subcontractor, against the District for money or damages, including without limitation Claims or portions thereof remaining in dispute after completion of the Section 9204 non-binding dispute resolution procedures described above are deemed a "suit for money or damages" and shall be subject to the provisions of Government Code §§945.4, 945.6 and 946 ("Government Code Claims Process"). An express condition precedent to the Contractor's initiation of Section 20104.4 Dispute Resolution Procedures or binding arbitration proceedings pursuant to the following is the Contractor's compliance with the Government Code Clams Process, including without limitation, presentation of the claim, demand, dispute, disagreement or other matter in controversy between the Contractor and the District seeking money or damages to the District and acted upon or deemed rejected by the District in accordance with Government Code §900, et seq.

16.11.5 Section 20104.4 Dispute Resolution Procedures; Claims Less Than $375,000. Any Claim, or portion thereof, in dispute after completion of the Section 9204 non-binding dispute resolution procedures and the Government Code Claims Process which is equal to or less $375,000 shall be resolved in accordance with the civil action procedures established in Public Contract Code §20104.4. Unless otherwise agreed to by the District and the Contractor in writing, the mediation conducted pursuant to Section 9204 procedures shall excuse any further obligation under Section 20104.4 to mediate after litigation has been commenced.

16.11.5.1 Binding Arbitration of Claims Exceeding $375,000.

16.11.5.1.1 JAMS Arbitration. Any Claim, or portion thereof in dispute after completion of the Section 9204 procedures and the Government Code Claims Process which exceeds $375,000 and any other claims, disputes, disagreements or other matters in controversy between the District and the Contractor arising out of, or related, in any manner, to the Contract Documents, or the interpretation, clarification or enforcement thereof shall be resolved by binding arbitration conducted before one (1) retired judge in accordance with the Construction Arbitration Rules and Procedures of Judicial Arbitration Mediation Services ("JAMS") in effect as of the date that a Demand for Arbitration is filed,

except as expressly modified herein. The locale for any arbitration commenced hereunder shall be the regional office of the JAMS closest to the Site.

16.11.5.2 Demand for Arbitration. A Demand for Arbitration shall be filed and served within a reasonable time after the occurrence of the claim, dispute or other disagreement giving rise to the Demand for Arbitration, but in no event shall a Demand for Arbitration be filed or served after the date when the institution of legal or equitable proceedings based upon such claim, dispute or other disagreement would be barred by the applicable statute of limitations. If more than one Demand for Arbitration is filed by either the District or the Contractor relating to the Work or the Contract Documents, all Demands for Arbitration shall be consolidated into a single arbitration proceeding, unless otherwise agreed to by the District and the Contractor. The Contractor's Surety, a Subcontractor or Material Supplier to the Contractor and other third parties may be permitted to join in and be bound by an arbitration commenced hereunder if required by the terms of their respective agreements with the Contractor, except to the extent that such joinder would unduly delay or complicate the expeditious resolution of the claim, dispute or other disagreement between the District and the Contractor, in which case an appropriate severance order shall be issued by the Arbitrator(s).

16.11.5.3 Discovery. In connection with any arbitration proceeding commenced hereunder, the discovery rights and procedures provided for in California Code of Civil Procedure §1283.05 shall be applicable, and the same shall be deemed incorporated herein by this reference.

16.11.5.4 Arbitration Award. The award rendered by the Arbitrator(s) ("Arbitration Award") shall be final and binding upon the District and the Contractor only if the Arbitration Award is: (i) supported by One Hundred Percent evidence; (ii) based on applicable legal standards in effect that the time the Arbitration Award is issued; and (iii) supported by written findings of fact and conclusions of law in conformity with California Code of Civil Procedure §1296. Any Arbitration Award that does not conform to the foregoing is invalid and unenforceable. The District and Contractor hereby expressly agree that the Court shall, subject to California Code of Civil Procedure §§1286.4 and 1296, vacate the Arbitration Award if, after review, the Court determines either that the Arbitration Award does not fully conform to the foregoing. The confirmation, enforcement, vacation or correction of an arbitration award rendered hereunder shall be made by the Superior Court of the State of California for the county in which the Site is situated. The substantive and procedural rules for such post-award proceedings shall be as set forth in California Code of Civil Procedure §1285 et seq.

16.11.5.5 Arbitration Fees and Expenses. The expenses and fees of the Arbitrator(s) shall be divided equally among all of the parties to the arbitration. Each party to any arbitration commenced hereunder shall be responsible for and shall bear its own attorneys' fees, witness fees and other costs or expenses incurred in connection with such arbitration. The foregoing notwithstanding, the Arbitrator(s) may award arbitration costs, including Arbitrators' fees but excluding attorneys' fees, to the prevailing party. By this arbitration provision, the District and the Contractor acknowledge and agree that neither shall recover from the other any attorney's fees associated with or arising out of any legal, administrative or other proceedings filed or instituted in connection with or arising out of the Contract Documents or the performance of either the District or the Contractor thereunder. The limited exceptions in the Contract Documents that provide attorney's fees for specific issues shall neither be construed as applying to this arbitration provision under California Civil Code §1717(a) nor be deemed to be "authorized by the Laws."

16.11.5.6 Limitation on Arbitrator. The Superior Court for the State of California for

the County in which the Project Site is situated has the sole and exclusive jurisdiction, and an arbitrator has no authority, to hear and/or determine a challenge to the commencement or maintenance of an arbitration proceeding on the grounds that: (i) the subject matter of the arbitration proceeding is barred by the applicable statute of limitations; (ii) the subject matter of the arbitration proceeding is barred by a provision of the California Government Claims Act; (iii) the subject matter of the arbitration proceeding is outside the scope of the arbitration clause; (iv) the Contractor has failed to satisfy all conditions precedent to commencement or maintenance of ab arbitration proceeding; (v) waiver of the right to compel arbitration; (vi) grounds exist for the revocation of the arbitration agreement; and/or, (vii) there is the prospect that a ruling in arbitration would conflict or potentially with a ruling in a pending proceeding regarding the Project on a common issue of law or fact.

16.11.6 Inapplicability to Bid Bond. The arbitration proceedings described above are not applicable to disputes, disagreements or enforcement of rights or obligations under the Bid Bond. All claims, disputes and actions to enforce rights or obligations under the Bid Bond shall be adjudicated only by judicial proceedings commenced in a court of competent jurisdiction.

16.12 Limitation on Special/Consequential Damages. In the event of the District's breach or default of its obligations under the Contract Documents, the damages, if any, recoverable by the Contractor shall be limited to general damages which are directly caused by the breach or default of the District and shall exclude any and all special or consequential damages, if any. The Contractor expressly acknowledges the foregoing limitation to recovery of only general damages from the District if the District is in breach or default of its obligations under the Contract Documents; the Contractor expressly waives and relinquishes any recovery of special or consequential damages from the District.

16.13 Capitalized Terms. Except as otherwise expressly provided, capitalized terms used in the Contract Documents shall have the meaning and definition for such term as set forth in the Contract Documents.

16.14 Attorneys' Fees. Except as expressly provided for in the Contract Documents, or authorized by law, neither the District nor the Contractor shall recover from the other any attorney's fees or other costs associated with or arising out of any legal, administrative or other proceedings filed or instituted in connection with or arising out of the Contract Documents or the performance of either the District or the Contractor thereunder.

16.15 Provisions Required by Law Deemed Inserted. Each and every provision of law and clause required by law to be inserted in the Contract Documents is deemed to be inserted herein and the Contract Documents shall be read and enforced as though such provision or clause are included herein, and if through mistake, or otherwise, any such provision or clause is not inserted or if not correctly inserted, then upon application of either party, the Contract Documents shall forthwith be physically amended to make such insertion or correction.

16.16 Days. Unless otherwise expressly stated, references to "days" in the Contract Documents shall be deemed to be calendar days.

16.17 Entire Agreement. The Contract Documents contain the entire agreement and understanding between the District and the Contractor concerning the subject matter hereof, and supersedes and replaces all prior negotiations, proposed agreements or amendments, whether written or oral. No amendment or modification to any provision of the Contract Documents shall be effective or enforceable except by an agreement in writing executed by the District and the Contractor.

[END OF SECTION]

SPECIAL CONDITIONS

AD1

1. Application of Special Conditions. These Special Conditions for a part of the Contract Documents for the Work described as **BID # 2024-19 AG TECH PROJECT**

2. Project Manager. The District will manage the project.

3. Drawings and Specifications. **(Available Electronically)**, The number of sets of the Drawings and Specifications which the District will provide to the Contractor, pursuant to Article 2.1.3 of the General Conditions is **Two (2)** Additional sets of the Drawings and Specifications may be obtained by the Contractor from the District at the cost of reproduction.

4. Insurance Coverages.

4.1. Contractor Insurance. Pursuant to Article 6 of the General Conditions, the Contractor shall obtain and maintain the following insurance coverages with minimum coverage amounts as set forth below:

Policy of Insurance	Minimum Coverage Amount
Commercial General Liability Insurance	Per Occurrence: Two Million Dollars ($2,000,000)
	Aggregate: Four Million Dollars ($4,000,000)
Workers Compensation	In accordance with the Laws
Employers Liability	One Million Dollars ($1,000,000)
Builders Risk	Full insurable value of the Work; Seismic coverage: Required

4.2. Subcontractor Insurance. Pursuant to Article 6 of the General Conditions, each Subcontractor shall obtain and maintain the following insurance coverages with minimum coverage amounts as set forth below

Policy of Insurance	Minimum Coverage Amount
Commercial General Liability Insurance	Per Occurrence: One Million Dollars ($1,000,000)
	Aggregate: Two Million Dollars ($2,000,000)
Workers Compensation	In accordance with the Laws
Employers Liability	One Million Dollars ($1,000,000)

5. Contract Time. The commencement date of the Contract Time of the Work shall be as set forth in the Notice to Proceed issued by or on behalf of the District. The Contractor shall achieve One Hundred Percent (100%) Completion of the Work by **553 Calendar days**. Time shall not be extended if the Contractor commences Work after the date established without fault or neglect of the District.

6. Liquidated Damages. The per diem rate of Liquidated Damages for delayed One Hundred Percent Completion, delayed submission of Submittals and delayed completion of Punchlist shall be as set forth herein.

6.1. Delayed One Hundred Percent Completion. If Completion is not achieved on or before expiration of the Contract Time, the Contractor shall be liable to the District for Liquidated Damages from the date of expiration of the Contract Time to the date that the Contractor achieves Completion of the Work at the per diem rate of Five Hundred

Dollars ($1,000.00).

6.2. Delayed Submission of Submittals. If the Contractor fails to submit a Submittal in accordance with the Submittal Schedule, the Contractor shall be liable to the District for Liquidated Damages for each delayed Submittal at the per diem rate of Five Hundred Dollars ($500.00) from the date that such Submittal was due to be submitted pursuant to the Submittal Schedule and the date that the Contractor actually submits the Submittal to the Architect.

6.3. Delayed Punchlist Completion. If the Contractor fails to complete Punchlist within the time established pursuant to the Contract Documents, the Contractor shall be liable to the District for Liquidated Damages from the date established for completion of Punchlist until the date that all Punchlist is actually completed at the per diem rate of Five Hundred Dollars ($500.00).

6.4. Surety Liability. Subject only to limitations established by the penal sum of the Performance Bond, the Surety issuing the Performance Bond shall be liable to the District for Liquidated Damages due from the Contractor.

7. Mark-Ups on Changes to the Work. In the event of Changes to the Work, pursuant to Article 9 of the General Conditions, the mark-up for all overhead (including home and field office overhead), general conditions costs and profit, shall not exceed the percentage of allowable direct actual costs for performance of the Change as set forth below.

7.1. Subcontractor Performed Changes. For the portion of any Change performed by Subcontractors of any tier, the percentage mark-up on allowable actual direct labor and materials costs incurred by all Subcontractors of any tier shall be **Ten Percent (10%)**. In addition, for the portion of any Change performed by a Subcontractor of any tier, the Contractor may add an amount equal to Four Percent (4%) of the allowable actual direct labor and materials costs of Subcontractors performing the Change; the foregoing mark-up shall not be applied to the Subcontractor mark-up.

7.2. Contractor Performed Changes. For the portion of any Change performed by the Contractor's own forces, the mark-up on the allowable actual direct labor and materials costs of such portion of a Change shall be **Ten Percent (10%)**.

7.3. Bond Premium Costs. In addition to the foregoing mark-ups on the direct costs of labor and materials, a bond premium expense in an amount equal to the lesser of the Contractor's actual bond premium rate of One Percent (1%) of the total actual direct costs of labor and materials (before Subcontractor and Contractor mark-ups) will be allowed.

7.4. Exclusions From Mark-Up of Actual Costs. Mark-ups on the actual cost of materials/equipment incorporated into a Change or for purchase/rental of Construction Equipment shall not be applied to any portion of such costs which are for sales, use or other taxes arising out of the purchase of materials/equipment and/or for purchase/rental of Construction Equipment.

8. Rain Days.

8.1. Rain Days Defined and Limitations on Rain Days. In addition to the requirements and limitations set forth in the Contract Documents, including without limitation Article 7.4.1 of the General Conditions, the Contract Time will be adjusted for unusually severe weather conditions resulting from rainfall only if: (i) the Contractor has taken reasonable measures to proceed with the Work notwithstanding inclement weather conditions;(ii) the Contractor demonstrates (by schedule analysis or other means) to the reasonable satisfaction of the District that the progress of Work on the critical path of the then current Construction Schedule was affected by unusually severe weather conditions resulting from rainfall; and (iii) the Contractor demonstrates to the reasonable satisfaction of the District that the Contractor could not re-sequence Work so that Work activities (whether or not on the critical path of

the then current Construction Schedule) not affected by rainfall could have been performed on a Rain Day. The occurrence of precipitation by itself shall not constitute a Rain Day. For purposes of the Contract Documents, a Rain Day occurs when: (ii) there is measurable rainfall occurring on a day when Work is scheduled to be performed at the Site; (ii) there is rainfall sufficiently continuous for at least a three (3) hour period; (iv) the rainfall is sufficiently severe to prevent performance of Work at the Site (rainfall is not deemed sufficiently severe to prevent Work at the Site if there are Work activities which are not materially affected by rainfall and which can be reasonably performed by the Contractor by re-sequencing Work activities); and (iv) after a Rain Day (as defined in (i), (ii) and (iii) above) has occurred, the conditions at the Site are adversely affected by rainfall so that a period of time is necessary to permit sufficient "drying out" of wet conditions at the Site sufficient to permit the continuation of Work.

8.2. Rain Days Incorporated Into Construction Schedules. Construction Schedules prepared by the Contractor shall incorporate the following Rain Days. The Contract Time shall not be subject to adjustment for unusually severe weather conditions until the number of Rain Days noted below are exceeded.

Month	Rain Days
January	four (4)
February	four (4)
March	three (3)
April	two (2)
May	two (2)
June	none
July	none
August	none
September	none
October	two (2)
November	three (3)
December	four (4)

9. Hours and Days of Work at the Site.

9.1. Work Hours/Days. Subject to limitations set forth elsewhere in the Contract Documents and below, the hours/days of Work at the Site are: 7am – 5pm Mondays through Fridays, except for holiday days.

9.2. Limitations on Work Hours/Days. Work activities at the Site will be limited or prohibited on days: (i) devoted to student testing or when testing of students may be adversely affected by Work activities at the Site; or (ii) when other special events or functions are scheduled. The Contractor shall familiarize itself with District activities at the Site to avoid Work activity interferences or disturbances to such District activities. The Contractor's Construction Schedule shall take into account the District activities which limit or preclude Work activities at the Site.

9.3. Facilities/Services for District Inspector. Unless otherwise expressly provided in the Contract Documents, pursuant to Article 4.14.2 of the General Conditions, the Contractor, without adjustment of the Contract Price, shall provide, or cause to be provided, for use by the District Inspector during prosecution of the Work, the following: (i) lockable temporary office space consisting of sufficient space to accommodate Project Inspectors assigned to the Work; (ii) furniture and furnishings consisting of desks and chairs for use by Project Inspectors assigned to the Work, file storage, one (1) conference table and seating sufficient to accommodate seating for at least four (4) people; (iii) landline phone; (iv) plain paper fax machine; (v) landline telephone and fax service; (vi) internet service; and (vii) plain paper copier

with copy speed of no greater than thirty five (35) pages per minute. **AD1**

10. Permits, Fees and Approvals. In addition to permits or approvals obtained by the District for the Work, the Contractor shall obtain the following permits, approvals and other authorizations from any public agency with jurisdiction over any portion of the Work. The Contractor shall obtain the permits, approvals and/or authorizations set forth below: (i) without adjustment of the Contract Price, unless otherwise indicated below; and (ii) without adjustment of the Contract Time.

Contractor Obtained Permit, Approval or Authorization	Cost Reimbursement
Deferred Approval Items	**No reimbursement to Contractor; cost included in Contract Price.**

For any work requiring City or County review and/or approval including the Merced County Health Department, Contractor shall coordinate and schedule inspections with City or County department

11. Construction Utilities. Refer to the TEMPORARY FACILITIES AND CONTROLS Specification Section.

12. Use of Site.
    - 12.1. Staging/Storage. Staging/storage areas shall be restricted to areas designated in the Contract Documents for such purposes. The Contractor, without adjustment of the Contract Price or the Contract Time, shall secure and pay for the use of additional storage, staging areas, or work areas needed for operations. The Contractor and Subcontractors are responsible for following the requirements established in the Contract Documents for deliveries, storage trailers, office trailers and temporary utilities. The Contractor and Subcontractors shall coordinate material and equipment deliveries with the District and to ensure that materials can be off-loaded efficiently and that Site use operations are maintained in an orderly fashion. If any materials or equipment stored at the Site obstruct the performance of any portion of the Project or otherwise interfere with District operations or activities, these materials shall be removed and relocated by the Contractor without adjustment of the Contract Price or the Contract Time. If the Contractor fails or refuses to comply with the foregoing staging/storage requirements and limitations within a reasonable time, but not more than twenty four (24) hours after notice, the District reserves the right to take measures to comply with such requirements or limitations, with the costs of such measures being the sole responsibility of the Contractor.
    - 12.2. Site Logistics Plan. Prior to commencement of Work at the Contractor, the Contractor prepare a Site Logistics Plan which include, without limitation: delivery routes, storage/staging areas, jobsite trailer locations, wash out areas, and other similar activities. The Site Logistics Plan shall: (i) take into account emergency vehicle ingress/egress; pedestrian paths of travel and disabled persons paths of travel; (ii) be subject to review and acceptance by the District; and (iii) be subject to modification during performance of the Work.
    - 12.3. Parking. Personnel of the Contractor, Subcontractors and others performing Work at the Site will be allowed to park vehicles in the staging area as designated in the specifications, or areas outside the Site, with a valid District parking permit, in the parking spaces at a location designated by the District. Parking permit charges, if any, shall be borne and paid by the Contractor without adjustment of the Contract

AD1

Price. The foregoing notwithstanding, the extent or location of parking for such personnel may be limited, restricted, eliminated or modified by the District as reasonably necessary to facilitate and accommodate necessary parking for the District's students, staff and visitors. Neither the Contract Price nor the Contract Time shall be adjusted as a result of any such District modifications to the extent or location of parking.

12.4. Prohibition on Smoking. The District has implemented policies and practices limiting and restricting smoking on District property, including the Site. The Contractor is solely responsible for obtaining the District's current non-smoking policy and: (i) notifying Subcontractors of the District's non-smoking policies; (ii) informing employees of the Contractor and Subcontractors of the District's non-smoking policies; (iii) posting notices at the Site summarizing the District's non-smoking policies; (iv) complying with the Laws relating to smoking limitations and restrictions; and (v) taking appropriate actions if the District's non-smoking policies are violated or limitations/restrictions imposed by the Laws are violated, including without limitation, removal of personnel violating such policies, limitations or restrictions.

[END OF SECTION]

AD1

California Community Colleges

MEMORANDUM
April 12, 2022

| Via Email

TO: Chief Business Officers

FROM: Marc A. LeForestier
General Counsel

RE: Contractor and Grantee Compliance with Economic Sanctions Imposed in Response to Russia's Invasion of Ukraine

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On March 4, 2022, Governor Gavin Newsom issued Executive Order N-6-22 (EO) (available here: http://www.gov.ca.gov/wp-content/uploads/2022/03/3.4.22-Russia-Ukraine-Executive-Order.pdf) regarding sanctions in response to the Russian invasion of Ukraine.

The EO directs all agencies and departments that are subject to the Governor's authority to take certain immediate steps, including notifying all contractors and grantees of their obligations to comply with existing economic sanctions imposed by the U.S. government in response to Russia's actions in Ukraine, as well as any sanctions imposed under state law. As you know, many community college districts contract with the California Community Colleges Board of Governors, and this memorandum is shared with the listserv for this purpose.

This correspondence serves as a notice under the EO that as a contractor or grantee, compliance with the economic sanctions imposed in response to Russia's actions in Ukraine is required, including with respect to, but not limited to, the federal executive orders identified in the EO and the sanctions identified on the U.S. Department of the Treasury website (https://home.treasury.gov/policy-issues/financial-sanctions/sanctions-programs-and-country-information/ukraine-russia-related-sanctions). Failure to comply may result in the termination of contracts or grants, as applicable. If you have any questions regarding compliance with these sanctions, they should be addressed to your legal counsel.

Please note that for any agreements or grants valued at $5 million or more, a separate notification will be sent outlining additional requirements specified under the EO.

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Chancellor's Office, Division Name
1102 Q Street, Sacramento, CA 95811 | 916.445.8752 | www.cccco.edu

AD1

EDA CONTRACTING GUIDELINES

In additional to California Public Contract Code and Educational Code, this project is also subject to the Federal U.S. Department of Commerce Economic Development Administration Provisions.

AD1

U. S. DEPARTMENT OF COMMERCE ECONOMIC DEVELOPMENT ADMINISTRATION

EDA CONTRACTING PROVISIONS FOR CONSTRUCTION PROJECTS

These EDA Contracting Provisions for Construction Projects (EDA Contracting Provisions) are intended for use by recipients receiving federal assistance from the U. S. Department of Commerce - Economic Development Administration (EDA). They contain provisions specific toEDA and other federal provisions not normally found in non-federal contract documents. The requirements contained herein must be incorporated into all construction contracts and subcontracts funded wholly or in part with federal assistance from EDA.

TABLE OF CONTENTS

1. DEFINITIONS

Agreement – The written instrument that is evidence of the agreement between the Owner and the Contractor overseeing the Work.

Architect/Engineer - The person or other entity engaged by the Recipient to perform architectural, engineering, design, and other services related to the work as provided for in the contract.

Contract – The entire and integrated written agreement between the Owner and the Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

Contract Documents – Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents.

Contractor – The individual or entity with whom the Owner has entered into the Agreement.

Drawings or Plans – That part of the Contract Documents prepared or approved by the Architect/Engineer that graphically shows the scope, extent, and character of the Work to be performed by the Contractor.

EDA - The United States of America acting through the Economic Development Administration of the U.S. Department of Commerce or any other person designated to act on its behalf. EDA has agreed to provide financial assistance to the Owner, which includes assistance in financing the Work to be performed under this Contract. Notwithstanding EDA's role, nothing in this Contract shall be construed to create any contractual relationship between the Contractor and EDA.

Owner – The individual or entity with whom the Contractor has entered into the Agreement and for whom the Work is to be performed.

Project – The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

Recipient – A non-Federal entity receiving a Federal financial assistance award directly from EDA to carry out an activity under an EDA program, including any EDA-approved successor to the entity.

Specifications – That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

Subcontractor – An individual or entity having direct contract with the Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

Work – The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

2. **APPLICABILITY**

The Project to which the construction work covered by this Contract pertains is being assisted bythe United States of America through federal assistance provided by the U.S. Department of Commerce - Economic Development Administration (EDA). Neither EDA, nor any of its departments, entities, or employees is a party to this Contract. The following EDA Contracting Provisions are included in this Contract and all subcontracts or related instruments pursuant to the provisions applicable to such federal assistance from EDA.

3. **FEDERALLY REQUIRED CONTRACT PROVISIONS**

(a) All contracts in excess of the simplified acquisition threshold - currently fixed at $150,000(*see* 41 U.S.C. §§ 134 and 1908) must address administrative, contractual, or legal remedies ininstances where contractors violate or breach contract terms, and provide for such sanctions and penalties as may be appropriate.

(b) All contracts in excess of $10,000 must address termination for cause and for convenienceby the Recipient including the manner by which it will be effected and the basis for settlement.

(c) All construction contracts awarded in excess of $10,000 by recipients of federal assistanceand their contractors or subcontractors shall contain a provision requiring compliance with Executive Order 11246 of September 24, 1965, *Equal Employment Opportunity*, as amended by Executive Order 11375 of October 13, 1967, and Department of Labor implementing regulations at 41 C.F.R. part 60.

(d) All prime construction contracts in excess of $2,000 awarded by Recipients must include aprovision for compliance with the Davis-Bacon Act (40 U.S.C. §§ 3141-3148) as supplementedby Department of Labor regulations at 29 C.F.R. part 5. The contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (18 U.S.C. § 874 and 40
U.S.C. § 3145) as supplemented by Department of Labor regulations at 29 C.F.R. part 3.

(e) All contracts awarded by the Recipient in excess of $100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. §§ 3702 and 3704(the Contract Work Hours and Safety Standards Act) as supplemented by Department of Labor regulations at 29 C.F.R. part 5.

(f) All contracts must include EDA requirements and regulations that involve a requirement on the contractor or sub-contractor to report information to EDA, the Recipient or any other federalagency.

(g) All contracts must include EDA requirements and regulations pertaining to patent rightswith respect to any discovery or invention which arises or is developed in the course of or under such contract.

(h) All contracts must include EDA requirements and regulations pertaining to copyrights andrights in data.

(i) All contracts and subgrants in excess of $150,000 must contain a provision that requires compliance with all applicable standards, orders, or requirements issued under the Clean Air Act(42 U.S.C. § 7401 *et seq.*) and the Federal Water Pollution Control Act (Clean Water Act) (33 U.S.C. § 1251 *et seq.*), and Executive Order 11738, *Providing for Administration of the Clean Air Act and the Federal Water Pollution Control Act With Respect to Federal Contracts, Grants,or Loans*.

(j) Contracts must contain mandatory standards and policies relating to energy efficiency whichare contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C.§ 6201).

(k) Contracts must contain a provision ensuring that contracts are not to be made to parties on the government wide Excluded Parties List System in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 C.F.R. part 180.

(l) Contracts must contain a provision ensure compliance with the Byrd Anti-Lobbying Amendment (31 U.S.C. § 1352) under which contractors that apply or bid for an award of $100,000 or more must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. §1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier upto the non-Federal award.

(m) If the Recipient is a state agency or agency of a political subdivision of a state, any contract awarded must contain a provision ensuring compliance with section 6002 of the SolidWaste Disposal Act (42 U.S.C. § 6962), as amended by the Resource Conservation and Recovery Act related to the procurement of recovered materials.

4. **REQUIRED PROVISIONS DEEMED INSERTED**

Each and every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein and the contract shall be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted, or is notcorrectly inserted, then upon the application of either party the contract shall forthwith be physically amended to make such insertion of correction.

5. INSPECTION BY EDA REPRESENTATIVES

The authorized representatives and agents of EDA shall be permitted to inspect all work, materials, payrolls, personnel records, invoices of materials, and other relevant data and records.

6. EXAMINATION AND RETENTION OF CONTRACTOR'S RECORDS

(a) The Owner, EDA, or the Comptroller General of the United States, or any of their duly authorized representatives shall, generally until three years after final payment under this contract, have access to and the right to examine any of the Contractor's directly pertinent books,documents, papers, or other records involving transactions related to this contract for the purposeof making audit, examination, excerpts, and transcriptions.

(b) The Contractor agrees to include in first-tier subcontracts under this contract a clause substantially the same as paragraph (a) above. "Subcontract," as used in this clause, excludespurchase orders that do not exceed $10,000.

(c) The periods of access and examination in paragraphs (a) and (b) above for records relating to (1) appeals under the disputes clause of this contract, (2) litigation or settlement of claims arisingfrom the performance of this contract, or (3) costs and expenses of this contract to which the Owner, EDA, or Comptroller General or any of their duly authorized representatives has taken exception shall continue until disposition of such appeals, litigation, claims, or exceptions.

7. CONSTRUCTION SCHEDULE AND PERIODIC ESTIMATES

Immediately after execution and delivery of the contract, and before the first partial payment is made, the Contractor shall deliver to the Owner an estimated construction progress schedule in a form satisfactory to the Owner, showing the proposed dates of commencement and completion of each of the various subdivisions of work required under the Contract Documents and the anticipated amount of each monthly payment that will become due to the Contractor in accordance with the progress schedule. The Contractor also shall furnish the Owner (a) a detailed estimate giving a complete breakdown of the contract price and (b) periodic itemized
estimates of work done for the purpose of making partial payments thereon. The costs employed in making up any of these schedules will be used only to determine the basis of partial payments and will not be considered as fixing a basis for additions to or deductions from the contract price.

8. CONTRACTOR'S TITLE TO MATERIAL

No materials, supplies, or equipment for the work shall be purchased by the Contractor or by any subcontractor that is subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. The Contractor warrants and guaranteesthat he/she has good title to all work, materials, and equipment used by him/her in the Work, freeand clear of all liens, claims, or encumbrances.

9. INSPECTION AND TESTING OF MATERIALS

All materials and equipment used in the completion of the Work shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be selected by the Owner. Materials of construction, particularly those upon whichthe strength and durability of any structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for intended uses.

10. "OR EQUAL" CLAUSE

Whenever a material, article, or piece of equipment is identified in the Contract Documents by reference to manufacturers' or vendors' names, trade names, catalogue numbers, etc., it is intended merely to establish a standard. Any material, article, or equipment of other manufacturers and vendors that will perform adequately the duties imposed by the general designwill be considered equally acceptable provided the material, article, or equipment so proposed is,in the opinion of the Architect/Engineer, of equal substance and function. However, such substitution material, article, or equipment shall not be purchased or installed by the Contractor without the Architect/Engineer's written approval.

11. PATENT FEES AND ROYALTIES

(a) Contractor shall pay all license fees and royalties and assume all costs incident to the use inthe performance of the Work or the incorporation in the Work of any invention, design, process, product, or device that is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documentsfor use in the performance of the Work and if, to the actual knowledge of Owner or Architect/Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by the Ownerin the Contract Documents.

(b) To the fullest extent permitted by Laws and Regulations, the Contractor shall indemnify andhold harmless the Owner and the Architect/Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against allclaims, costs, losses, and damages (including but not limited to all fees and charges of engineers,architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

12. CLAIMS FOR EXTRA COSTS

No claims for extra work or cost shall be allowed unless the same was done in pursuance of awritten order from the Architect/Engineer approved by the Owner.

13. CONTRACTORS AND SUBCONTRACTORS INSURANCE

(a) The Contractor shall not commence work under this Contract until the Contractor has obtained all insurance reasonably required by the Owner, nor shall the Contractor allow any subcontractor to commence work on his/her subcontract until the insurance required of the subcontractor has been so obtained and approved.

(b) Types of insurance normally required are:

(1) Workers' Compensation
(2) Contractor's Public Liability and Property Damage
(3) Contractor's Vehicle Liability
(4) Subcontractors' Public Liability, Property Damage and Vehicle Liability
(5) Builder's Risk (Fire and Extended Coverage)

(c) **Scope of Insurance and Special Hazards:** The insurance obtained, which is described above, shall provide adequate protection for the Contractor and his/her subcontractors, respectively, against damage claims that may arise from operations under this contract, whethersuch operations be by the insured or by anyone directly or indirectly employed by him/her and also against any of the special hazards that may be encountered in the performance of this Contract.

(d) **Proof of Carriage of Insurance:** The Contractor shall furnish the Owner with certificates showing the type, amount, class of operations covered, effective dates, and dates of expiration ofapplicable insurance policies.

14. CONTRACT SECURITY BONDS

(a) If the amount of this Contract exceeds $150,000, the Contractor shall furnish a performancebond in an amount at least equal to one hundred percent (100%) of the Contract price as securityfor the faithful performance of this Contract and also a payment bond in an amount equal to onehundred percent (100%) of the Contract price or in a penal sum not less than that prescribed by State, Territorial, or local law, as security for the payment of all persons performing labor on theWork under this Contract and furnishing materials in connection with this Contract. The performance bond and the payment bond may be in one or in separate instruments in accordancewith local law. Before final acceptance, each bond must be approved by EDA. If the amount ofthis Contract does not exceed $150,000, the Owner shall specify the amount of the payment andperformance bonds.

(b) All bonds shall be in the form prescribed by the Contract Documents except as otherwise provided in applicable laws or regulations, and shall be executed by such sureties as are named in the current list of *Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies* as published in Treasury Circular 570(amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of theTreasury. All bonds signed by an agent must be accompanied by a certified copy of the agent's authority to act. Surety companies executing the bonds must also be authorized to transactbusiness in the state where the Work is located.

15. **LABOR STANDARDS - DAVIS-BACON AND RELATED ACTS(as required by section 602 of PWEDA)** **AD1**

(a) **Minimum Wages**

(1) All laborers and mechanics employed or working upon the site of the Work in the construction or development of the Project will be paid unconditionally and not less oftenthan once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act at 29 C.F.R. part 3, the full amount of wages and bona fide fringebenefits (or cash equivalents thereof) due at the time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor, which is attached hereto and made a part hereof, regardless of any contractual relationship that may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are consideredwages paid to such laborers or mechanics, subject to the provisions of 29 C.F.R.
§ 5.5(a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rateand fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 C.F.R. § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the
rate specified for each classification for the time actually worked therein, provided that theemployer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates determined under 29 C.F.R. § 5.5(a)(1)(ii) and the Davis- Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(2) (i) Any class of laborers or mechanics to be employed under the Contract, but not listed in the wage determination, shall be classified in conformance with the wage determination. EDA shall approve an additional classification and wage rate and fringebenefits therefore only when the following criteria have been met:

(A) The work to be performed by the classification requested is not performed by a classification in the wage determination;

(B) The classification is utilized in the area by the construction industry; and

(C) The proposed wage rate, including any bona fide fringe benefits, bears a

reasonable relationship to the wage rates contained in the wage determination.

(ii) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and EDA or its designee agree on theclassification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by EDA or its designee tothe Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, D.C. 20210.

(iii) In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives, and EDA or its designee do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), EDA or its designee shall refer the questions, including the views of all interested parties and the recommendation of EDA or its designee, tothe Administrator for determination.

(iv) The wage rate (including fringe benefits where appropriate) determined pursuantto paragraphs (a)(2)(ii) or (iii) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(3) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(4) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of theContractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets forthe meeting of obligations under the plan or program.

(b) **Withholding**

EDA or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the Contractor under this Contract or any other federal contract with the same prime Contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the Contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee or helper employed or working on the site of the Work in the construction or development of the Project, all or part of the wages required by the Contract, EDA or its designee may, after written notice to the Contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations

have ceased. EDA or its designee may, after written notice to the Contractor, disburse such amounts withheld for and on account of the Contractor or subcontractor to the respective employees to whom they are due. The Comptroller General shall make such disbursements in thecase of direct Davis-Bacon Act contracts.

(c) **Payrolls and basic records**

(1) Payrolls and basic records relating thereto shall be maintained by the Contractorduring the course of the Work and preserved for a period of three years thereafter forall laborers and mechanics working at the site of the Work in the construction or development of the Project. Such records shall contain the name, address, and socialsecurity number of each such worker, his or her correct classification, hourly rates ofwages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 C.F.R.
§ 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program describedin section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, the plan orprogram is financially responsible, and the plan or program has been communicatedin writing to the laborers or mechanics affected, and provide records that show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(2) (i) For each week in which Contract work is performed, the Contractor shall submit a copy of all payrolls to the Owner for transmission to EDA or its designee. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 C.F.R. part 5.5(a)(3)(i). This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose. It may be purchased from the Superintendent of Documents (Federal Stock Number 029-005-00014-1), U.S. Government Printing Office, Washington, D.C. 20402; or downloaded from the U.S. Department of Labor's website at https://www.dol.gov/whd/forms/wh347.pdf. The prime Contractor is responsible for the submission of copies of payrolls by all subcontractors

(ii) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervisesthe payment of the persons employed under the Contract and shall certify the following:

(A) That the payroll for the payroll period contains the information required to be maintained under 29 C.F.R. § 5.5(a)(3)(i) and that such information is correct and complete;

(B) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the Contract during the payroll period has been paid the fullweekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 C.F.R. part 3; and

(C) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into theContract.

(iii)The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submissionof the "Statement of Compliance" required by paragraph 15(c)(2)(ii) of this section.

(iv)The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under section 1001 of Title 18 and section 3729 of Title 31 of the U.S. Code.

(3) The Contractor or subcontractor shall make the records required under paragraph 15(c)(1) of this section available for inspection, copying, or transcription by authorized representatives of EDA or its designee or the Department of Labor, and shall permit suchrepresentatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, EDA or its designee may, after written notice to the Contractor or Owner, take such action as may be necessary to cause the suspension of any further payment, advance,or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29
C.F.R. § 5.12.

(d) **Apprentices and Trainees**.

(1) **Apprentices**. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training (Bureau), or with a State Apprenticeship Agency recognized by the Bureau, or ifa person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any

apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a Contractor is performing construction on a Project in a locality other than that in which its program is registered,the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed.
Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourlyrate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the fullamount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(2) **Trainees**. Except as provided in 29 C.F.R. § 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employedpursuant to and individually registered in a program that has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and

Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman's hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount offringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with thecorresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will nolonger be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(3) **Equal employment opportunity**. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity

requirements of Executive Order 11246, *Equal Employment Opportunity*, as amended,and 29 C.F.R. part 30.

(e) **Compliance with Copeland Anti-Kickback Act Requirements**. The Contractor shall comply with the Copeland Anti-Kickback Act (18 U.S.C. § 874 and 40 U.S.C. § 3145) as supplemented by Department of Labor regulations (29 C.F.R. part 3, "Contractors and Subcontractors on Public Buildings or Public Works Financed in Whole or in Part by Loans or Grants of the United States"). The Act provides that the Contractor and any subcontractors shallbe prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which they are otherwise entitled. The Owner shall report all suspected or reported violations to EDA.

(f) **Subcontracts**. The Contractor and any subcontractors will insert in any subcontracts the clauses contained in 29 C.F.R. §§ 5.5(a)(1) through (10) and such other clauses as EDA or its designee may require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 C.F.R. § 5.5.

(g) **Contract termination; debarment**. The breach of the contract clauses in 29 C.F.R. § 5.5may be grounds for termination of the contract, and for debarment as a Contractor and a subcontractor as provided in 29 C.F.R. § 5.12.

(h) **Compliance with Davis-Bacon and Related Act Requirements**. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 C.F.R. parts 1, 3, and 5 areherein incorporated by reference in this contract.

(i) **Disputes concerning labor standards**. Disputes arising out of the labor standards provisions of this Contract shall not be subject to the general disputes clause of this Contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 C.F.R. parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and EDA or its designee, the U.S.Department of Labor, or the employees or their representatives.

(j) **<u>Certification of Eligibility</u>**.

(1)By entering into this Contract, the Contractor certifies that neither it nor any person orfirm that has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 C.F.R. § 5.12(a)(1).

(2) No part of this Contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 C.F.R. § 5.12(a)(1).

(3) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. § 1001.

16. **LABOR STANDARDS - CONTRACT WORK HOURS AND SAFETY STANDARDS ACT**

As used in this paragraph, the terms "laborers" and "mechanics" include watchmen and guards.

(a) **Overtime requirements**. No Contractor or subcontractor contracting for any part of the Contract work, which may require or involve the employment of laborers or mechanics, shall require or permit any such laborer or mechanic in any workweek in which that person is employed on such work to work in excess of forty hours in such workweek unless such laboreror mechanic receives compensation at a rate not less than one and one-half times the basic rateof pay for all hours worked in excess of forty hours in such workweek.

(b) **Violation; liability for unpaid wages, liquidated damages**. In the event of any violation ofthe clause set forth in paragraph (a) of this section, the Contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a) of this section, in the sum of $10 for each calendar day on which such individual was required or

permitted to work in excess of the standard workweek of forty hours without payment of theovertime wages required by the clause set forth in paragraph (a) of this section.

(c) **Withholding for unpaid wages and liquidated damages**. EDA or its designee shall upon its own action or upon written request of an authorized representative of the Department of Laborwithhold or cause to be withheld, from any monies payable on account of work performed

by the Contractor or subcontractor under any such Contract or any other federal contract with thesame prime Contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b) of this section.

(d) **Subcontracts**. The Contractor or subcontractor shall insert in any subcontracts the clauses setforth in paragraphs (a) through (c) of this section and also a clause requiring the subcontractors toinclude these clauses in any lower tier subcontracts. The prime Contractor shall be responsible forcompliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a) through (c) of this section.

17. **EQUAL EMPLOYMENT OPPORTUNITY**

(a) The Recipient hereby agrees that it will incorporate or cause to be incorporated into anycontract for construction work, or modification thereof, as defined in the regulations of the Secretary of Labor at 41 C.F.R. chapter 60, which is paid for in whole or in part with fundsobtained from EDA, the following equal opportunity clause:

During the performance of this contract, the Contractor agrees as follows:

(1) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; ratesof pay or other forms of compensation; and selection for training including apprenticeship. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The Contractor will, in all solicitations or advertisements for employees placed by oron behalf of the Contractor state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.

(3) The contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.

(4) The Contractor will send to each labor union or representative of workers with whichit has a collective bargaining agreement or other contract or understanding, a notice to beprovided advising the said labor union or workers representatives of the Contractor's commitments hereunder, and shall post copies of the notice in conspicuous placesavailable to employees and applicants for employment.

(5) The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965 and of the rules, regulations, and relevant orders of the Secretary ofLabor.

(6) The Contractor will furnish all information and reports required by Executive Order11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts byEDA and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(7) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this Contract or with any of the said rules, regulations, or orders, this Contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts or federally-assisted construction contracts in accordance

with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked asprovided in Executive Order 11246 of September 24, 1965, or by rule, regulation or order of the Secretary of Labor, or as otherwise provided by law.

(8) The Contractor will include the portion of the sentence immediately preceding paragraph 17(a)(1) and the provisions of paragraphs 17(a)(1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchaseorder as EDA or the Secretary of Labor may direct as a means of enforcing such provisions, including sanctions for noncompliance. Provided, however, that in the eventthe Contractor becomes involved in or is threatened with litigation with a subcontractor or vendor as a result of such direction by EDA or the Secretary of Labor, the Contractormay request the United States to enter into such litigation to protect the interests of the United States.

(9) The Recipient further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally- assisted construction work. Provided, however, that if the Recipient so participating is aState or local government, the above equal opportunity clause is not applicable to any agency, instrumentality, or subdivision of such government that does not participate in work on or under the Contract.

(10)The Recipient agrees that it will assist and cooperate actively with EDA and the Secretary of Labor in obtaining the compliance of contractors and subcontractors with theequal opportunity clause and the rules, regulations, and relevant orders of the Secretary ofLabor, that it will furnish EDA and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist EDA inthe discharge of the EDA's primary responsibility for securing compliance.

(11) The Recipient further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a Contractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and subcontractors by EDA or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the Recipientagrees that if it fails or refuses to comply with these undertakings, EDA may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this EDA financial assistance; refrain from extending any further assistance to the applicant under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the caseto the Department of Justice for appropriate legal proceedings.

(b) Exemptions to Above Equal Opportunity Clause (41 C.F.R. chapter 60):

(1) Contracts and subcontracts not exceeding $10,000 (other than Government bills of lading, and other than contracts and subcontracts with depositories of Federal funds inany amount and with financial institutions which are issuing and paying agents for U.S.savings bonds and savings notes) are exempt. The amount of the Contract, rather thanthe amount of the federal financial assistance, shall govern in determining the applicability of this exemption.

(2) Except in the case of subcontractors for the performance of construction work at the site of construction, the clause shall not be required to be inserted in subcontracts below the second tier.

(3) Contracts and subcontracts not exceeding $10,000 for standard commercial suppliesor raw materials are exempt.

18. **CONTRACTING WITH SMALL, MINORITY AND WOMEN'S BUSINESSES**

(a) If the Contractor intends to let any subcontracts for a portion of the work, the Contractor shall take affirmative steps to assure that small, minority and women's businesses are used whenpossible as sources of supplies, equipment, construction, and services.

(b) Affirmative steps shall consist of:

(1) Placing qualified small and minority businesses and women's business enterprises onsolicitation lists;

(2) Ensuring that small and minority businesses and women's business enterprises aresolicited whenever they are potential sources;

(3) Dividing total requirements, when economically feasible, into smaller tasks orquantities to permit maximum participation by small and minority businesses and women's business enterprises;

(4) Establishing delivery schedules, where the requirements of the contract permit, whichencourage participation by small and minority businesses and women's business enterprises;

(5) Using the services and assistance of the U.S. Small Business Administration, the Minority Business Development Agency of the U.S. Department of Commerce, and State and local governmental small business agencies;

(6) Requiring each party to a subcontract to take the affirmative steps of this section; and

(7) The Contractor is encouraged to procure goods and services from labor surplus areafirms.

19. **HEALTH, SAFETY, AND ACCIDENT PREVENTION**

(a) In performing this contract, the Contractor shall:

(1) Ensure that no laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to their healthand/or safety as determined under construction safety and health standards promulgatedby the Secretary of Labor by regulation;

(2) Protect the lives, health, and safety of other persons;

(3) Prevent damage to property, materials, supplies, and equipment; and

(4) Avoid work interruptions.

(b) For these purposes, the Contractor shall:

(1) Comply with regulations and standards issued by the Secretary of Labor at 29 C.F.R.part 1926. Failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act (40 U.S.C. §§ 3701 – 3708); and

(2) Include the terms of this clause in every subcontract so that such terms will bebinding on each subcontractor.

(c) The Contractor shall maintain an accurate record of exposure data on all accidents incident towork performed under this Contract resulting in death, traumatic injury, occupational disease, or damage to property, materials, supplies, or equipment, and shall report this data in the manner prescribed by 29 C.F.R. part 1904.

(d) The Owner shall notify the Contractor of any noncompliance with these requirements and ofthe corrective action required. This notice, when delivered to the Contractor or the Contractor's representative at the site of the Work, shall be deemed sufficient notice of the noncompliance and corrective action required. After receiving the notice, the Contractor shall immediately takecorrective action. If the Contractor fails or refuses to take corrective action promptly, the Ownermay issue an order stopping all or part of the Work until satisfactory corrective action has been taken. The Contractor shall not base any claim or request for equitable adjustment for additionaltime or money on any stop order issued under these circumstances.

(e) The Contractor shall be responsible for its subcontractors' compliance with the provisions ofthis clause. The Contractor shall take such action with respect to any subcontract as EDA, or theSecretary of Labor shall direct as a means of enforcing such provisions.

20. **CONFLICT OF INTEREST AND OTHER PROHIBITED INTERESTS** **AD1**

(a) No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept, or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction or material supply contract orany subcontract in connection with the construction of the Project, shall become directly or indirectly interested personally in this Contract or in any part hereof.

(b) No officer, employee, architect, attorney, engineer, or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the Project, shall become directly or indirectly interested personally in this Contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to theProject.

(c) The Contractor may not knowingly contract with a supplier or manufacturer if the individualor entity who prepared the Contract Documents has a corporate or financial affiliation with the supplier or manufacturer.

(d) The Owner's officers, employees, or agents shall not engage in the award or administrationof this Contract if a conflict of interest, real or apparent, may be involved. Such a conflict mayarise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has afinancial interest in the Contractor. The Owner's officers, employees, or agents shall neither solicit nor accept gratuities, favors, or anything of monetary value from the Contractor or subcontractors.

(e) If the Owner finds after a notice and hearing that the Contractor, or any of the Contractor's agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of the Owner or EDA in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, the Owner may, by written notice to the Contractor, terminate this Contract. The Owner may also pursue other rights and remedies that the law or this Contract

provides. However, the existence of the facts on which the Owner bases such findings shall bean issue and may be reviewed in proceedings under the dispute resolution provisions of this Contract.

(f) In the event this Contract is terminated as provided in paragraph (e) of this section, the Owner may pursue the same remedies against the Contractor as it could pursue in the event of a breach of this Contract by the Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, the Owner may pursue exemplary damages in an amount (as determined by the Owner) which shall not be less than three nor more than ten times the costs theContractor incurs in providing any such gratuities to any such officer or employee.

21. **RESTRICTIONS ON LOBBYING**

(a) This Contract, or subcontract is subject to 31 U.S.C. § 1352, regarding lobbying restrictions. The section is explained in the common rule, 15 C.F.R. part 28 (55 FR 6736-6748, February 26, 1990). Each bidder under this Contract or subcontract is generally prohibited from using federal funds for lobbying the Executive or Legislative Branches of the Federal Government in connection with this EDA Award.

(b) **Contract Clause Threshold**: This Contract Clause regarding lobbying must be included ineach bid for a contract or subcontract exceeding $100,000 of federal funds at any tier under the EDA Award.

(c) **Certification and Disclosure**: Each bidder of a contract or subcontract exceeding $100,000 of federal funds at any tier under the federal Award must file Form CD-512, *Certification Regarding Lobbying – Lower Tier Covered Transactions*, and, if applicable, Standard Form-LLL, *Disclosure of Lobbying Activities*, regarding the use of any nonfederal funds for lobbying. Certifications shall be retained by the Contractor or subcontractor at the next higher tier. All disclosure forms, however, shall be forwarded from tier to tier until received by the Recipient ofthe EDA Award, who shall forward all disclosure forms to EDA.

(d) **Continuing Disclosure Requirement**: Each Contractor or subcontractor that is subject to the Certification and Disclosure provision of this Contract Clause is required to file a disclosure form at the end of each calendar quarter in which there occurs any event that requires disclosure or that materially affects the accuracy of the information contained in any disclosure form previously filed by such person. Disclosure forms shall be forwarded from tier to tier until received by the Recipient of the EDA Award, who shall forward all disclosure forms to EDA.

(e) **Indian Tribes, Tribal Organizations, or Other Indian Organizations**: Indian tribes, tribal organizations, or any other Indian organizations, including Alaskan Native organizations, are excluded from the above lobbying restrictions and reporting requirements, but only with respect to expenditures that are by such tribes or organizations for lobbying activities permitted by other federal law. An Indian tribe or organization that is seeking an exclusion from Certification and Disclosure requirements must provide EDA with the citation of the provision or

provisions of federal law upon which it relies to conduct lobbying activities that would otherwise be subject to the prohibitions in and to the Certification and Disclosure requirements of 31 U.S.C. § 1352, preferably through an attorney's opinion. Note, also, that a non-Indian subrecipient, contractor, or subcontractor under an award to an Indian tribe, for example, issubject to the restrictions and reporting requirements.

22. **HISTORICAL AND ARCHAEOLOGICAL DATA PRESERVATION**

The Contractor agrees to facilitate the preservation and enhancement of structures and objects of historical, architectural or archaeological significance and when such items are found and/or unearthed during the course of project construction. Any excavation by the Contractor that uncovers an historical or archaeological artifact shall be immediately reported to the Owner and

a representative of EDA. Construction shall be temporarily halted pending the notification process and further directions issued by EDA after consultation with the State Historic Preservation Officer (SHPO) for recovery of the items. *See* the National Historic Preservation Act of 1966 (54 U.S.C. § 300101 *et seq.*, formerly at 16 U.S.C. § 470 *et seq.*) and Executive Order No. 11593 of May 31, 1971.

23. **CLEAN AIR AND WATER**

Applicable to Contracts in Excess of $150,000

(a) **Definition**. "Facility" means any building, plant, installation, structure, mine, vessel, or other floating craft, location, or site of operations, owned, leased, or supervised by the Contractoror any subcontractor, used in the performance of the Contract or any subcontract. When a location or site of operations includes more than one building, plant, installation, or structure, theentire location or site shall be deemed a facility except when the Administrator, or a designee, of the United States Environmental Protection Agency (EPA) determines that independent facilitiesare collocated in one geographical area.

(b) In compliance with regulations issued by the EPA, 2 C.F.R. part 1532, pursuant to the Clean Air Act, as amended (42 U.S.C. § 7401 *et seq*.); the Federal Water Pollution Control Act, as amended (33 U.S.C. § 1251 *et seq*.); and Executive Order 11738, the Contractor agrees to:

(1) Not utilize any facility in the performance of this contract or any subcontract which islisted on the Excluded Parties List System, part of the System for Award Management (SAM), pursuant to 2 C.F.R. part 1532 for the duration of time that the facility remains onthe list;

(2) Promptly notify the Owner if a facility the Contractor intends to use in the performance of this contract is on the Excluded Parties List System or the Contractor knows that it has been recommended to be placed on the List;

(3) Comply with all requirements of the Clean Air Act and the Federal Water Pollution Control Act, including the requirements of section 114 of the Clean Air Act and section 308 of the Federal Water Pollution Control Act, and all applicable clean air and clean water standards; and

(4) Include or cause to be included the provisions of this clause in every subcontract and take such action as EDA may direct as a means of enforcing such provisions.

24. **USE OF LEAD-BASED PAINTS ON RESIDENTIAL STRUCTURES**

(a) If the work under this Contract involves construction or rehabilitation of residential structuresover $5,000, the Contractor shall comply with the Lead-based Paint Poisoning Prevention Act(42 U.S.C. § 4831). The Contractor shall assure that paint or other surface coatings used in a residential property does not contain lead equal to or in excess of 1.0 milligram per square centimeter or 0.5 percent by weight or 5,000 parts per million (ppm)

by weight. For purposes of this section, "residential property" means a dwelling unit, common areas, building exteriorsurfaces, and any surrounding land, including outbuildings, fences and play equipment affixed to the land, belonging to an owner and available for use by residents, but not including land used for agricultural, commercial, industrial or other non-residential purposes,and not including paint on the pavement of parking lots, garages, or roadways.

(b) As a condition to receiving assistance under PWEDA, recipients shall assure that the restriction against the use of lead-based paint is included in all contracts and subcontracts involving the use of federal funds.

25. ENERGY EFFICIENCY

The Contractor shall comply with all standards and policies relating to energy efficiency which are contained in the energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C. § 6201) for the State in which the Work under the Contract is performed.

26. ENVIRONMENTAL REQUIREMENTS

When constructing a Project involving trenching and/or other related earth excavations, the Contractor shall comply with the following environmental constraints:

(1) **Wetlands**. When disposing of excess, spoil, or other construction materials on public or private property, the Contractor shall not fill in or otherwise convert wetlands.

(2) **Floodplains**. When disposing of excess, spoil, or other construction materials on public or private property, the Contractor shall not fill in or otherwise convert 100 year floodplain areas delineated on the latest Federal Emergency Management Agency (FEMA) Floodplain Maps, or other appropriate maps, i.e., alluvial soils on Natural Resource Conservation Service (NRCS) Soil Survey Maps.

(3) **Endangered Species**. The Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of the Contractor, the Contractor will immediately report this evidence to the Owner and a representative of EDA. Construction shall be temporarily halted pending the notification process and further directions issued by EDA after consultation with the U.S. Fish and Wildlife Service.

27. **DEBARMENT, SUSPENSION, INELIGIBILITY, AND VOLUNTARY EXCLUSIONS**

As required by Executive Orders 12549 and 12689, *Debarment and Suspension*, 2 C.F.R. Part 180and implemented by the Department of Commerce at 2 C.F.R. part 1326, for prospective participants in lower tier covered transactions (except subcontracts for goods or services under the
$25,000 small purchase threshold unless the subrecipient will have a critical influence on or substantive control over the award), the Contractor agrees that:

(1) By entering into this Contract, the Contractor and subcontractors certify, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this Contract by any federaldepartment or agency.

(2) Where the Contractor or subcontractors are unable to certify to any of the statements in this certification, the Contractor or subcontractors shall attach an explanation to this bid.

See also 2 C.F.R. part 180 and 2 C.F.R. § 200.342.

28. **EDA PROJECT SIGN**

The Contractor shall supply, erect, and maintain in good condition a Project sign according to the specifications provided by EDA. To the extent practical, the sign should be a free standing sign. Project signs shall not be located on public highway rights-of-way. Location and height of signs will be coordinated with the local agency responsible for highway or street safety in the Project area, if any possibility exists for obstructing vehicular traffic line of sight. Whenever the EDA site sign specifications conflict with State law or local ordinances, the EDA Regional Director will permit such conflicting specifications to be modified so as to comply with State law or local ordinance.

29. **BUY AMERICA**

To the greatest extent practicable, contractors are encouraged to purchase American-made equipment and products with funding provided under EDA financial assistanceawards.

AD1

CERTIFICATION REGARDING LOBBYING
LOWER TIER COVERED TRANSACTIONS

Applicants should review the instructions for certification included in the regulations before completing this form. Signature
on this form provides for compliance with certification requirements under 15 CFR Part 28, "New Restrictions on Lobbying."

LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 15 CFR Part 28, for
persons entering into a grant, cooperative agreement or contract over $100,000 or a loan or loan
guarantee over $150,000 as defined at 15 CFR Part 28, Sections
28.105 and 28.110, the applicant certifies that to the best of his or her knowledge and belief,
that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the
undersigned, to any person for influencing or attempting to influence an officer or employee of any
agency, a Member of Congress in connection with the awarding of any Federal contract, the making
of any Federal grant, the making of any Federal loan, the entering into of any cooperative
agreement, and the extension, continuation, renewal, amendment, or modification of any
Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any
person for influencing or attempting to influence an officer or employee of any agency, a Member of
Congress, an officer or employee of Congress, or an employee of a member of Congress in connection
with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete
and submit Standard Form-LLL, ''Disclosure Form to Report Lobbying,'' in accordance with its
instructions.

(3) The undersigned shall require that the language of this certification be included in
the award documents for all subawards at all tiers (including subcontracts, subgrants, and
contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify
and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this
transaction was made or entered into. Submission of this certification is a prerequisite for making
or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who
fails to file the required certification shall be subject to a civil penalty of not less than
$10,000 and not more than $100,000 for each such failure occurring on or before October
23, 1996, and of not less than $11,000 and not more than $110,000 for each such failure occurring

Statement for Loan Guarantees and Loan Insurance

The undersigned states, to the best of his or her knowledge and belief, that:

In any funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this commitment providing for the United States to insure or guarantee a loan, the undersigned shall complete and submit Standard Form-LLL, ''Disclosure Form to Report Lobbying,'' in accordance with its instructions.

Submission of this statement is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required statement shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure occurring on or before October 23, 1996, and of not less than $11,000 and not more than $110,000 for each such failure occurring after October 23, 1996.

after October 23, 1996.
As the duly authorized representative of the applicant, I hereby certify that the applicant will comply with the above applicable certification.
NAME OF APPLICANT AWARD NUMBER AND/OR PROJECT NAME
PRINTED NAME AND TITLE OF AUTHORIZED REPRESENTATIVE
SIGNATURE DATE

Back

NOTICE OF REQUIREMENTS FOR AFFIRMATIVE ACTIONTO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246 AND 41 CFR PART 60-4)

The following Notice shall be included in, and shall be a part of all solicitations for offers and bids on all Federal and federally assisted construction contracts or subcontracts in excess of $10,000.

The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "StandardFederal Equal Employment Opportunity Construction Contract Specifications" set forth herein.

The goals and timetables for minority and female participation, expressed in percentage terms forthe Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Timetables	Goals for minority female participation for each trade for each trade	Goals for participation
What % to use?	**19.8%**	**6.9 %**

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals forboth its federally involved and non federally involved construction.
The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60- 4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of thesubcontract; and the geographical area in which the subcontract is to be performed.

As used in this Notice, and in the contract resulting from this solicitation, the "coveredarea" is:

State of **California**

County of **Merced**

City of **Merced**_____

Variations and Usage

There is one approved mark associated with the Investing In America logo. To preserve the integrity of the Investing In America logo mark, make sure to apply them correctly. Altering, distorting, or recreating the 'marks' in any way weakens the power of the image and what it represents. Layout and design of signs and communication materials will vary, so care must be taken when applying the logo mark.

Primary Logo Mark

INVESTING IN AMERICA

Colors

The colors, graphics, and fonts used should conform to graphic standards.

COLOR	CMYK	RGB	HEX	PMS
Blue	83, 48, 0, 48	22 / 68 / 132	#164484	PMS 7687 C
Red	0, 100, 81, 0	255 / 0 / 49	#FF0031	PMS 185 C
White	2, 2, 0, 3	242 / 244 / 248	#F2F4F8	Bright White

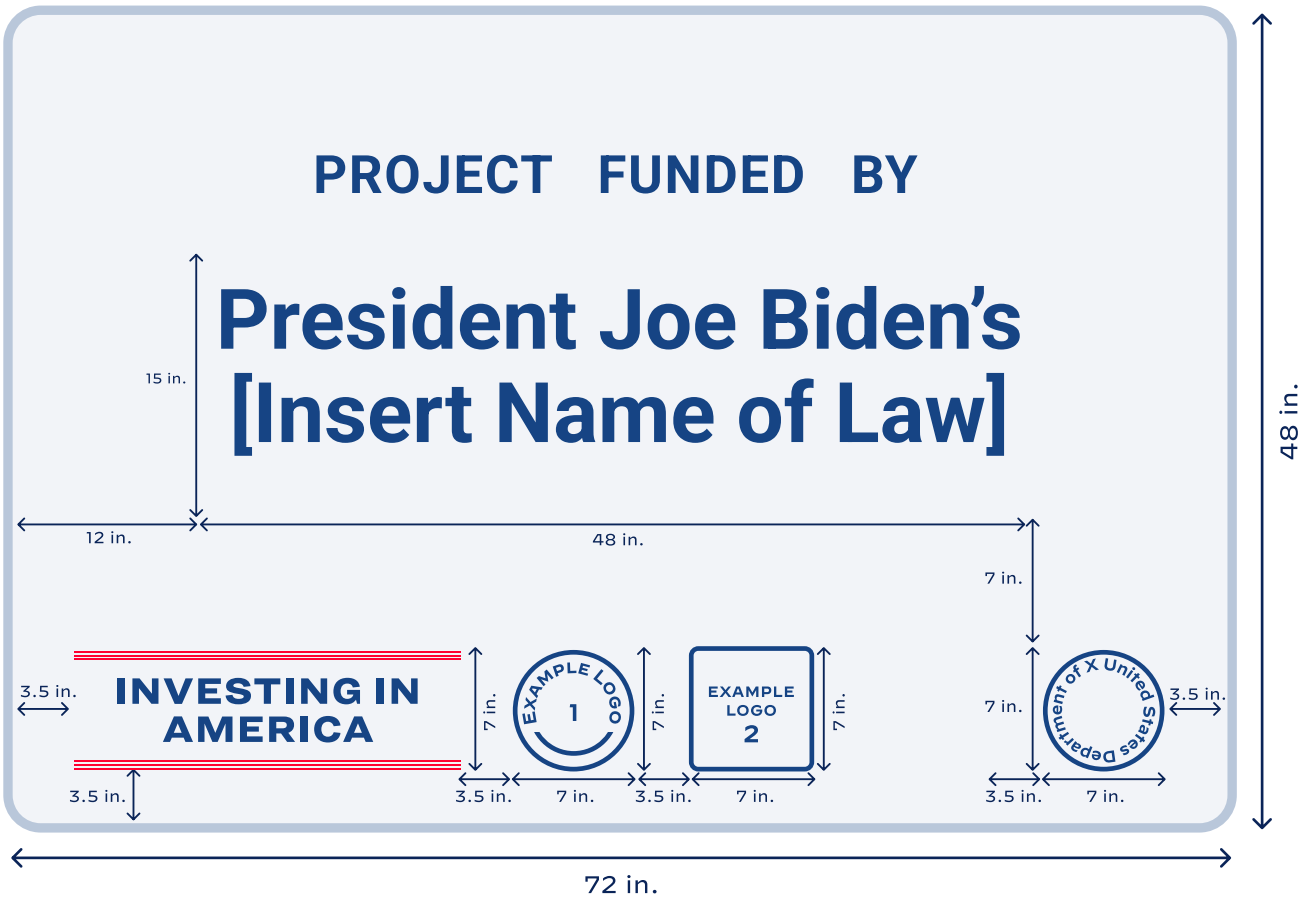
Logos

White background: logo in red and blue

Gray background: logo in red and blue

Blue background: logo in all white

Investing In America General Guidelines for Logo Applications



Name of Law: American Rescue Plan
Department of X United States Logo: United States Department of Commerce Logo
Example Logo 1: Grantee Logo

Use of the Example Logo 2 location is subject to review and approval by EDA.

Sign Colors

4. The American Rescue Plan

Sign color scheme to be selected by the Owner

White

Gray

Blue

Red Border

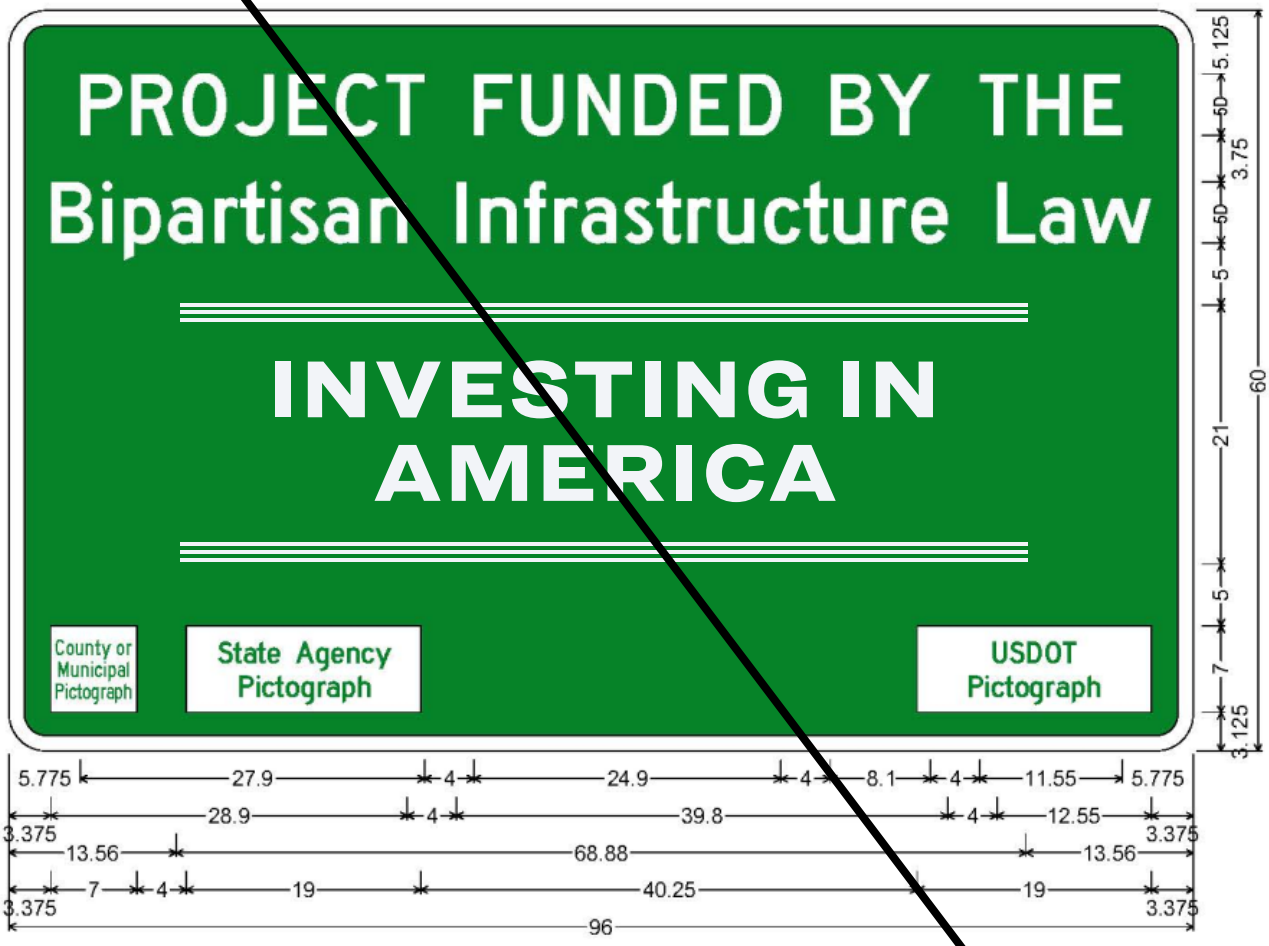
State, City, and County Logo Variations

Square or Circular State Logo: 7x7 in.

Rectangular or Oval State Logo: **not** to exceed 17.5 x 7 in.

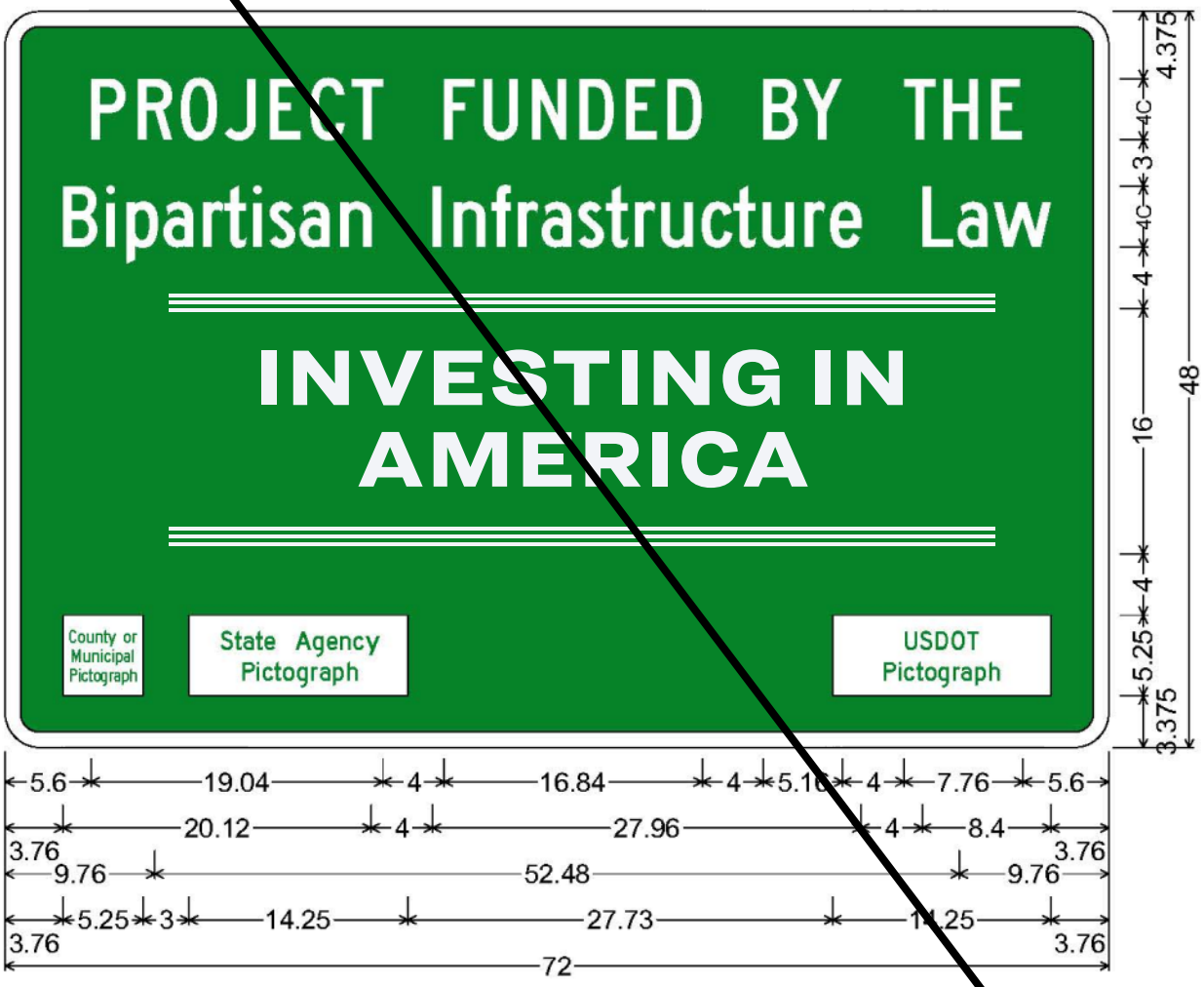
Rules for Highway Right of Way Signage 8 Feet

Not Applicable



Rules for Highway Right of Way Signage 6 Feet

Not Applicable



United States Department of Commerce Logo

AD1

Jet Black, Blue (PMS300), and Gold (PMS7406)

Grantee Logo

AD1

Refer to: https://www.mccd.edu/about-merced-college/divisions/external-relations/brand-guide/

MERCED
COLLEGE

OMB Number: 0610-0096
Expiration Date: 01/31/2025

AD1

EDA PROJECT SIGN

The Contractor shall supply, erect, and maintain in good condition a project sign according to the specifications set forth below:

EDA SITE SIGN SPECIFICATIONS

Size: ~~4' x 8' x ¾"~~ **4' X 6' X 3/4"**

Materials: Exterior grade/MDO plywood (APA rating A-B)

Supports: 4" x 4" x 12' posts with 2" x 4" cross branching

Erection: Posts shall be set a minimum of three feet deep in concrete footings that are at least 12" in diameter.

Paint: Outdoor enamel

Colors: **As indicated in the previous pages**

Lettering: **Araboto, if available. Araboto font is not a typical font face. Therefore, Roboto is an acceptable substitute. Roboto is an open-source font and can be downloaded through the following URL**

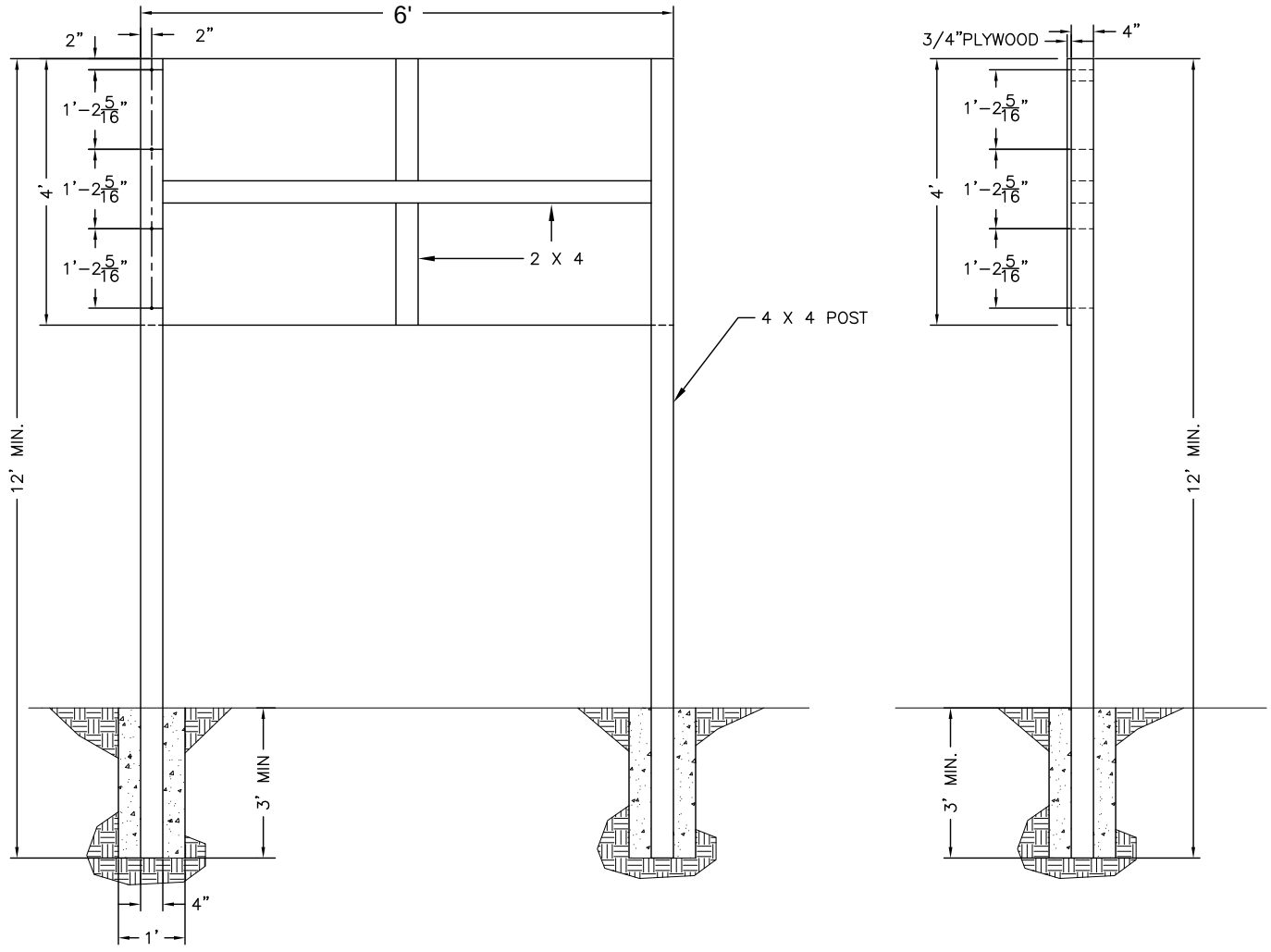
https://fonts.google.com/specimen/Roboto

Project signs will not be erected on public highway rights-of-way. If any possibility exists for obstruction to traffic line of sight, the location and height of the sign will be coordinated with the agency responsible for highway or street safety in the area.

The EDA Regional Director may permit modifications to these specifications if they conflict with state law or local ordinances.

OMB Number: 0610-0096
Expiration Date: 01/31/2025

AD1



PLYWOOD SIGN

Not to Scale

PROJECT – SIGN
ECONOMIC DEVELOPMENT ADMINISTRATION

DAVIS BACON WAGE RATES

AD1

Note: State of California DIR (Department of Industrial Relations) Prevailing Wage Rates shall supersede the following Federal rates for any trade where the DIR rates are listed higher. Refer to: http:// www.dir.ca.gov/dlsr/statistics research.html

"General Decision Number: CA20250018 01/03/2025

Superseded General Decision Number: CA20240018

State: California

Construction Types: Building, Heavy (Heavy and Dredging) and Highway

Counties: Alameda, Calaveras, Contra Costa, Fresno, Kings, Madera, Mariposa, Merced, Monterey, San Benito, San Francisco, San Joaquin, San Mateo, Santa Clara, Santa Cruz, Stanislaus and Tuolumne Counties in California.

BUILDING CONSTRUCTION PROJECTS; DREDGING PROJECTS (does not include hopper dredge work); HEAVY CONSTRUCTION PROJECTS (does not include water well drilling); HIGHWAY CONSTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all

	hours spent performing on that contract in 2025.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number: 0
Publication Date: 01/03/2025

ASBE0016-004 05/01/2024

AREA 1: CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, MONTEREY, SAN BENITO, SAN JOAQUIN, SANTA CRUZ, STANISLAUS & TOULMNE COUNTIES

AREA 2: ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO & SANTA CLARA COUNTIES

	Rates	Fringes
Asbestos Removal worker/hazardous material handler (Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials from mechanical systems, whether they contain asbestos or not)		
Area 1	$ 34.56	11.40
Area 2	$ 36.53	9.27

ASBE0016-008 01/01/2024

AREA 1: ALAMEDA, CONTRA COSTA, MONTEREY, SAN BENITO, SAN FRANCISCO, SAN MATEO, SANTA CLARA, & SANTA CRUZ

AREA 2: CALAVERAS, COLUSA, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS, & TUOLUMNE

	Rates	Fringes
Asbestos Workers/Insulator (Includes the application of all insulating materials, Protective Coverings,		

Coatings, and Finishes to all
types of mechanical systems)
Area 1.....$ 84.76 25.07
Area 2.....$ 64.56 25.07

BOIL0549-001 01/01/2021

AREA 1: ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO & SANTA CLARA COUNTIES

AREA 2: REMAINING COUNTIES

	Rates	Fringes
BOILERMAKER		
Area 1	$ 49.62	41.27
Area 2	$ 45.60	38.99

BRCA0003-001 08/01/2023

	Rates	Fringes
MARBLE FINISHER	$ 41.18	18.58

BRCA0003-003 08/01/2023

	Rates	Fringes
MARBLE MASON	$ 60.20	28.82

BRCA0003-005 05/01/2024

	Rates	Fringes
BRICKLAYER		
(1) Fresno, Kings, Madera, Mariposa, Merced	$ 51.17	25.80
(7) San Francisco, San Mateo	$ 57.02	28.50
(8) Alameda, Contra Costa, San Benito, Santa Clara	$ 56.94	26.28
(9) Calaveras, San Joaquin, Stanislaus, Toulumne	$ 52.76	25.01
(16) Monterey, Santa Cruz	$ 54.18	27.82

BRCA0003-008 07/01/2023

	Rates	Fringes
TERRAZZO FINISHER	$ 43.90	19.51
TERRAZZO WORKER/SETTER	$ 59.06	28.31

BRCA0003-011 04/01/2024

AREA 1: Alameda, Contra Costa, Monterey, San Benito, San Francisco, San Mateo, Santa Clara, Santa Cruz

AREA 2: Calaveras, San Joaquin, Stanislaus, Tuolumne

AREA 3: Fresno, Kings, Madera, Mariposa, Merced

	Rates	Fringes
TILE FINISHER		
Area 1	$ 37.75	19.28
Area 2	$ 34.76	19.22
Area 3	$ 32.68	18.32
Tile Layer		
Area 1	$ 59.92	22.62
Area 2	$ 55.17	22.52
Area 3	$ 50.28	22.05

CARP0022-001 07/01/2023

San Francisco County

	Rates	Fringes
Carpenters		
Bridge Builder/Highway Carpenter	$ 60.39	33.52
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 60.54	33.52
Journeyman Carpenter	$ 60.39	33.52
Millwright	$ 60.49	35.11

CARP0034-001 07/01/2021

	Rates	Fringes
Diver		
Assistant Tender, ROV Tender/Technician	$ 54.10	34.69
Diver standby	$ 60.51	34.69
Diver Tender	$ 59.51	34.69
Diver wet	$ 103.62	34.69
Manifold Operator (mixed gas)	$ 64.51	34.69
Manifold Operator (Standby)	$ 59.51	34.69

DEPTH PAY (Surface Diving):
050 to 100 ft $2.00 per foot
101 to 150 ft $3.00 per foot
151 to 220 ft $4.00 per foot
221 ft.-deeper $5.00 per foot

SATURATION DIVING:
The standby rate shall apply until saturation starts. The saturation diving rate applies when divers are under pressure continuously until work task and decompression are complete. The diver rate shall be paid for all saturation

hours.

DIVING IN ENCLOSURES:
Where it is necessary for Divers to enter pipes or tunnels, or other enclosures where there is no vertical ascent, the following premium shall be paid: Distance traveled from entrance 26 feet to 300 feet: $1.00 per foot. When it is necessary for a diver to enter any pipe, tunnel or other enclosure less than 48"" in height, the premium will be $1.00 per foot.

WORK IN COMBINATION OF CLASSIFICATIONS:
Employees working in any combination of classifications within the diving crew (except dive supervisor) in a shift are paid in the classification with the highest rate for that shift.

CARP0034-003 07/01/2021

	Rates	Fringes
Piledriver	$ 54.10	34.69

CARP0035-007 07/01/2020

AREA 1: Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara counties

AREA 2: Monterey, San Benito, Santa Cruz Counties

AREA 3: Calaveras, Fresno, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, Tuolumne Counties

	Rates	Fringes
Modular Furniture Installer		
Area 1		
Installer	$ 28.76	22.53
Lead Installer	$ 32.21	23.03
Master Installer	$ 36.43	23.03
Area 2		
Installer	$ 26.11	22.53
Lead Installer	$ 29.08	23.03
Master Installer	$ 32.71	23.03
Area 3		
Installer	$ 25.16	22.53
Lead Installer	$ 27.96	23.03
Master Installer	$ 31.38	23.03

CARP0035-008 08/01/2020

AREA 1: Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara counties

AREA 2: Monterey, San Benito, Santa Cruz Counties

AREA 3: San Joaquin

AREA 4: Calaveras, Fresno, Kings, Madera, Mariposa, Merced, Stanislaus, Tuolumne Counties

	Rates	Fringes
Drywall Installers/Lathers:		
Area 1	$ 52.65	31.26
Area 2	$ 46.77	31.26
Area 3	$ 47.27	31.26
Area 4	$ 45.92	31.26
Drywall Stocker/Scrapper		
Area 1	$ 26.33	18.22
Area 2	$ 23.39	18.22
Area 3	$ 23.64	18.22
Area 4	$ 22.97	18.22

CARP0152-001 07/01/2020

Contra Costa County

	Rates	Fringes
Carpenters		
Bridge Builder/Highway Carpenter	$ 52.65	30.82
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 52.80	30.82
Journeyman Carpenter	$ 52.65	30.82
Millwright	$ 52.75	32.41

CARP0152-002 07/01/2020

San Joaquin County

	Rates	Fringes
Carpenters		
Bridge Builder/Highway Carpenter	$ 52.65	30.82
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 46.92	30.82
Journeyman Carpenter	$ 46.77	30.82
Millwright	$ 49.27	32.41

CARP0152-004 07/01/2020

Calaveras, Mariposa, Merced, Stanislaus and Tuolumne Counties

	Rates	Fringes
Carpenters		

Bridge Builder/Highway Carpenter	$ 52.65	30.82
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 45.57	30.82
Journeyman Carpenter	$ 45.42	30.82
Millwright	$ 47.92	32.41

CARP0217-001 07/01/2023

San Mateo County

	Rates	Fringes
Carpenters		
Bridge Builder/Highway Carpenter	$ 60.39	33.52
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 60.54	33.52
Journeyman Carpenter	$ 60.39	33.52
Millwright	$ 60.49	35.11

CARP0405-001 07/01/2021

Santa Clara County

	Rates	Fringes
Carpenters		
Bridge Builder/Highway Carpenter	$ 54.85	31.49
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 55.00	31.49
Journeyman Carpenter	$ 54.85	31.49
Millwright	$ 54.95	33.08

CARP0405-002 07/01/2021

San Benito County

	Rates	Fringes
Carpenters		
Bridge Builder/Highway Carpenter	$ 54.85	31.49
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 49.12	31.49
Journeyman Carpenter	$ 48.97	31.49

Millwright	$ 51.47	33.08

CARP0505-001 07/01/2021

Santa Cruz County

	Rates	Fringes
Carpenters		
Bridge Builder/Highway Carpenter	$ 54.85	31.49
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 49.12	31.49
Journeyman Carpenter	$ 48.97	31.49
Millwright	$ 51.47	33.08

CARP0605-001 07/01/2021

Monterey County

	Rates	Fringes
Carpenters		
Bridge Builder/Highway Carpenter	$ 54.85	31.49
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 49.12	31.49
Journeyman Carpenter	$ 48.97	31.49
Millwright	$ 51.47	33.08

CARP0701-001 07/01/2021

Fresno and Madera Counties

	Rates	Fringes
Carpenters		
Bridge Builder/Highway Carpenter	$ 54.85	31.49
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 47.77	31.49
Journeyman Carpenter	$ 47.62	31.49
Millwright	$ 50.12	33.08

CARP0713-001 07/01/2021

Alameda County

	Rates	Fringes

Carpenters		
Bridge Builder/Highway Carpenter	$ 54.85	31.49
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 55.00	31.49
Journeyman Carpenter	$ 54.85	31.49
Millwright	$ 54.95	33.08

CARP1109-001 07/01/2021

Kings County

	Rates	Fringes
Carpenters		
Bridge Builder/Highway Carpenter	$ 54.85	31.49
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 47.77	31.49
Journeyman Carpenter	$ 47.62	31.49
Millwright	$ 50.12	33.08

ELEC0006-004 11/01/2023

SAN FRANCISCO COUNTY

	Rates	Fringes
Sound & Communications		
Installer	$ 51.68	3%+24.65
Technician	$ 59.43	3%+24.65

SCOPE OF WORK: Including any data system whose only function is to transmit or receive information; excluding all other data systems or multiple systems which include control function or power supply; inclusion or exclusion of terminations and testings of conductors determined by their function; excluding fire alarm work when installed in raceways (including wire and cable pulling) and when performed on new or major remodel building projects or jobs for which the conductors for the fire alarm system are installed in conduit; excluding installation of raceway systems, line voltage work, industrial work, life-safety systems (all buildings having floors located more than 75' above the lowest floor level having building access); excluding energy management systems.

FOOTNOTE: Fire alarm work when installed in raceways (including wire and cable pulling), on projects which involve new or major remodel building construction, for which the conductors for the fire alarm system are installed in the conduit, shall be performed by the inside electrician.

ELEC0006-007 06/01/2024

SAN FRANCISCO COUNTY

	Rates	Fringes
ELECTRICIAN	$ 91.25	3%+45.315

ELEC0100-002 06/01/2024

FRESNO, KINGS, AND MADERA COUNTIES

	Rates	Fringes
ELECTRICIAN	$ 45.00	29.15

ELEC0100-005 12/01/2024

FRESNO, KINGS, MADERA

	Rates	Fringes
Communications System		
Installer	$ 45.28	28.01
Technician	$ 52.07	28.21

SCOPE OF WORK

Includes the installation testing, service and maintenance, of the following systems which utilize the transmission and/or transference of voice, sound, vision and digital for commercial, education, security and entertainment purposes for the following: TV monitoring and surveillance, background-foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multi-media, multiplex, nurse call system, radio page, school intercom and sound, burglar alarms, and low voltage master clock systems.

A. SOUND AND VOICE TRANSMISSION/TRANSFERENCE SYSTEMS Background foreground music, Intercom and telephone interconnect systems, Telephone systems Nurse call systems, Radio page systems, School intercom and sound systems, Burglar alarm systems, Low voltage, master clock systems, Multi-media/multiplex systems, Sound and musical entertainment systems, RF systems, Antennas and Wave Guide,

B. FIRE ALARM SYSTEMS Installation, wire pulling and testing

C. TELEVISION AND VIDEO SYSTEMS Television monitoring and surveillance systems Video security systems, Video entertainment systems, Video educational systems, Microwave transmission systems, CATV and CCTV

D. SECURITY SYSTEMS Perimeter security systems Vibration sensor systems Card access systems Access control systems, Sonar/infrared monitoring equipment

E. COMMUNICATIONS SYSTEMS THAT TRANSMIT OR RECEIVE INFORMATION AND/OR CONTROL SYSTEMS THAT ARE INTRINSIC TO THE ABOVE LISTED SYSTEMS SCADA (Supervisory Control and Data Acquisition) PCM (Pulse Code Modulation) Inventory Control Systems, Digital Data Systems Broadband and Baseband and Carriers Point of Sale Systems, VSAT Data Systems Data Communication Systems RF and Remote Control Systems, Fiber Optic Data Systems

WORK EXCLUDED Raceway systems are not covered (excluding Ladder-Rack for the purpose of the above listed systems). Chases and/or nipples (not to exceed 10 feet) may be installed on open wiring systems. Energy management systems. SCADA (Supervisory Control and Data Acquisition) when not intrinsic to the above listed systems (in the scope). Fire alarm systems when installed in raceways (including wire and cable pulling) shall be performed at the electrician wage rate, when either of the following two (2) conditions apply:
1. The project involves new or major remodel building trades construction.
2. The conductors for the fire alarm system are installed in conduit.

ELEC0234-001 12/25/2023

MONTEREY, SAN BENITO AND SANTA CRUZ COUNTIES

	Rates	Fringes
ELECTRICIAN		
Zone A	$ 65.16	29.55
Zone B	$ 71.68	29.75

Zone A: All of Santa Cruz, Monterey, and San Benito Counties within 25 air miles of Highway 1 and Dolan Road in Moss Landing, and an area extending 5 miles east and west of Highway 101 South to the San Luis Obispo County Line

Zone B: Any area outside of Zone A

ELEC0234-003 12/01/2021

MONTEREY, SAN BENITO, AND SANTA CRUZ COUNTIES

	Rates	Fringes
Sound & Communications		
Installer	$ 47.93	24.09
Technician	$ 55.12	24.30

SCOPE OF WORK: Including any data system whose only function is to transmit or receive information; excluding all other data systems or multiple systems which include control function or power supply; inclusion or exclusion of terminations and testings of conductors determined by their function; excluding fire alarm work when installed

in raceways (including wire and cable pulling) and when performed on new or major remodel building projects or jobs for which the conductors for the fire alarm system are installed in conduit; excluding installation of raceway systems, line voltage work, industrial work, life-safety systems (all buildings having floors located more than 75' above the lowest floor level having building access); excluding energy management systems.

FOOTNOTE: Fire alarm work when installed in raceways (including wire and cable pulling), on projects which involve new or major remodel building construction, for which the conductors for the fire alarm system are installed in the conduit, shall be performed by the inside electrician.

ELEC0302-001 02/27/2023

CONTRA COSTA COUNTY

	Rates	Fringes
CABLE SPLICER	$ 68.92	32.67
ELECTRICIAN	$ 61.26	32.44

ELEC0302-003 12/01/2023

CONTRA COSTA COUNTY

	Rates	Fringes
Sound & Communications		
Installer	$ 48.44	27.60
Technician	$ 55.71	27.82

SCOPE OF WORK: Including any data system whose only function is to transmit or receive information; excluding all other data systems or multiple systems which include control function or power supply; inclusion or exclusion of terminations and testings of conductors determined by their function; excluding fire alarm work when installed in raceways (including wire and cable pulling) and when performed on new or major remodel building projects or jobs for which the conductors for the fire alarm system are installed in conduit; excluding installation of raceway systems, line voltage work, industrial work, life-safety systems (all buildings having floors located more than 75' above the lowest floor level having building access); excluding energy management systems.

FOOTNOTE: Fire alarm work when installed in raceways (including wire and cable pulling), on projects which involve new or major remodel building construction, for which the conductors for the fire alarm system are installed in the conduit, shall be performed by the inside electrician.

ELEC0332-001 06/01/2024

SANTA CLARA COUNTY

	Rates	Fringes
CABLE SPLICER	$ 100.25	46.72
ELECTRICIAN	$ 87.17	46.33

FOOTNOTES: Work under compressed air or where gas masks are required, orwork on ladders, scaffolds, stacks, ""Bosun's chairs,"" or other structures and where the workers are not protected by permanent guard rails at a distance of 40 to 60 ft. from the ground or supporting structures: to be paid one and one-half times the straight-time rate of pay. Work on structures of 60 ft. or over (as described above): to be paid twice the straight-time rate of pay.

ELEC0332-003 12/01/2023

SANTA CLARA COUNTY

	Rates	Fringes
Sound & Communications		
Installer	$ 53.18	27.745
Technician	$ 61.16	27.985

SCOPE OF WORK: Including any data system whose only function is to transmit or receive information; excluding all other data systems or multiple systems which include control function or power supply; inclusion or exclusion of terminations and testings of conductors determined by their function; excluding fire alarm work when installed in raceways (including wire and cable pulling) and when performed on new or major remodel building projects or jobs for which the conductors for the fire alarm system are installed in conduit; excluding installation of raceway systems, line voltage work, industrial work, life-safety systems (all buildings having floors located more than 75' above the lowest floor level having building access); excluding energy management systems.

FOOTNOTE: Fire alarm work when installed in raceways (including wire and cable pulling), on projects which involve new or major remodel building construction, for which the conductors for the fire alarm system are installed in the conduit, shall be performed by the inside electrician.

ELEC0595-001 06/01/2024

ALAMEDA COUNTY

	Rates	Fringes
CABLE SPLICER	$ 84.18	3%+44.68

ELECTRICIAN.....$ 73.20 3%+44.68

ELEC0595-002 06/01/2024

CALAVERAS AND SAN JOAQUIN COUNTIES

	Rates	Fringes
CABLE SPLICER	$ 59.34	3%+30.48
ELECTRICIAN		
(1) Tunnel work	$ 51.92	3%+30.48
(2) All other work	$ 49.45	3%+30.48

ELEC0595-006 12/01/2024

ALAMEDA COUNTY

	Rates	Fringes
Sound & Communications		
Installer	$ 56.68	3%+26.65
Technician	$ 65.18	3%+26.65

SCOPE OF WORK: Including any data system whose only function is to transmit or receive information; excluding all other data systems or multiple systems which include control function or power supply; inclusion or exclusion of terminations and testings of conductors determined by their function; excluding fire alarm work when installed in raceways (including wire and cable pulling) and when performed on new or major remodel building projects or jobs for which the conductors for the fire alarm system are installed in conduit; excluding installation of raceway systems, line voltage work, industrial work, life-safety systems (all buildings having floors located more than 75' above the lowest floor level having building access); excluding energy management systems.

FOOTNOTE: Fire alarm work when installed in raceways (including wire and cable pulling), on projects which involve new or major remodel building construction, for which the conductors for the fire alarm system are installed in the conduit, shall be performed by the inside electrician.

ELEC0595-008 12/01/2024

CALAVERAS AND SAN JOAQUIN COUNTIES

	Rates	Fringes
Communications System		
Installer	$ 45.28	3%+26.65
Technician	$ 52.07	3%+26.65

SCOPE OF WORK: Including any data system whose only function is to transmit or receive information; excluding all other data systems or multiple systems which include control

function or power supply; inclusion or exclusion of terminations and testings of conductors determined by their function; excluding fire alarm work when installed in raceways (including wire and cable pulling) and when performed on new or major remodel building projects or jobs for which the conductors for the fire alarm system are installed in conduit; excluding installation of raceway systems, line voltage work, industrial work, life-safety systems (all buildings having floors located more than 75' above the lowest floor level having building access); excluding energy management systems.

FOOTNOTE: Fire alarm work when installed in raceways (including wire and cable pulling), on projects which involve new or major remodel building construction, for which the conductors for the fire alarm system are installed in the conduit, shall be performed by the inside electrician.

ELEC0617-001 06/01/2024

SAN MATEO COUNTY

	Rates	Fringes
ELECTRICIAN	$ 82.00	48.05

ELEC0617-003 12/01/2023

SAN MATEO COUNTY

	Rates	Fringes
Sound & Communications		
Installer	$ 53.18	27.75
Technician	$ 61.16	27.98

SCOPE OF WORK: Including any data system whose only function is to transmit or receive information; excluding all other data systems or multiple systems which include control function or power supply; inclusion or exclusion of terminations and testings of conductors determined by their function; excluding fire alarm work when installed in raceways (including wire and cable pulling) and when performed on new or major remodel building projects or jobs for which the conductors for the fire alarm system are installed in conduit; excluding installation of raceway systems, line voltage work, industrial work, life-safety systems (all buildings having floors located more than 75' above the lowest floor level having building access); excluding energy management systems.

FOOTNOTE: Fire alarm work when installed in raceways (including wire and cable pulling), on projects which involve new or major remodel building construction, for which the conductors for the fire alarm system are installed in the conduit, shall be performed by the inside electrician.

ELEC0684-001 12/01/2024

MARIPOSA, MERCED, STANISLAUS AND TUOLUMNE COUNTIES

	Rates	Fringes
ELECTRICIAN	$ 48.50	30.09

CABLE SPLICER = 110% of Journeyman Electrician

ELEC0684-004 12/01/2023

MARIPOSA, MERCED, STANISLAUS AND TUOLUMNE COUNTIES

	Rates	Fringes
Communications System		
Installer	$ 42.48	27.42
Technician	$ 48.85	27.62

SCOPE OF WORK: Including any data system whose only function is to transmit or receive information; excluding all other data systems or multiple systems which include control function or power supply; inclusion or exclusion of terminations and testings of conductors determined by their function; excluding fire alarm work when installed in raceways (including wire and cable pulling) and when performed on new or major remodel building projects or jobs for which the conductors for the fire alarm system are installed in conduit; excluding installation of raceway systems, line voltage work, industrial work, life-safety systems (all buildings having floors located more than 75' above the lowest floor level having building access); excluding energy management systems.

FOOTNOTE: Fire alarm work when installed in raceways (including wire and cable pulling), on projects which involve new or major remodel building construction, for which the conductors for the fire alarm system are installed in the conduit, shall be performed by the inside electrician.

ELEC1245-001 06/01/2024

	Rates	Fringes
LINE CONSTRUCTION		
(1) Lineman; Cable splicer	$ 70.16	24.46
(2) Equipment specialist (operates crawler tractors, commercial motor vehicles, backhoes, trenchers, cranes (50 tons and below), overhead & underground distribution line equipment)	$ 53.30	22.01

(3) Groundman	$ 40.76	21.51
(4) Powderman	$ 51.87	18.79

HOLIDAYS: New Year's Day, M.L. King Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day and day after Thanksgiving, Christmas Day

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ELEV0008-001 01/01/2024

	Rates	Fringes
ELEVATOR MECHANIC	$ 80.76	37.885+a+b

FOOTNOTE:
a. PAID VACATION: Employer contributes 8% of regular hourly rate as vacation pay credit for employees with more than 5 years of service, and 6% for 6 months to 5 years of service.
b. PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, Friday after Thanksgiving, and Christmas Day.

ENGI0003-001 06/28/2023

""AREA 1"" WAGE RATES ARE LISTED BELOW

""AREA 2"" RECEIVES AN ADDITIONAL $2.00 PER HOUR ABOVE AREA 1 RATES.

SEE AREA DEFINITIONS BELOW

	Rates	Fringes
OPERATOR: Power Equipment (AREA 1:)		
GROUP 1	$ 60.72	31.03
GROUP 2	$ 59.19	31.03
GROUP 3	$ 57.71	31.03
GROUP 4	$ 56.33	31.03
GROUP 5	$ 55.06	31.03
GROUP 6	$ 53.74	31.03
GROUP 7	$ 52.60	31.03
GROUP 8	$ 51.46	31.03
GROUP 8-A	$ 49.25	31.03
OPERATOR: Power Equipment (Cranes and Attachments - AREA 1:)		
GROUP 1		
Cranes	$ 52.30	31.15
Oiler	$ 43.79	31.15
Truck crane oiler	$ 46.08	31.15
GROUP 2		
Cranes	$ 50.54	31.15
Oiler	$ 42.83	31.15
Truck crane oiler	$ 45.07	31.15
GROUP 3		
Cranes	$ 48.80	31.15

Hydraulic	$ 44.44	31.15
Oiler	$ 42.55	31.15
Truck crane oiler	$ 44.83	31.15
GROUP 4		
Cranes	$ 45.76	31.15
OPERATOR: Power Equipment (Piledriving - AREA 1:)		
GROUP 1		
Lifting devices	$ 52.64	31.15
Oiler	$ 43.38	31.15
Truck Crane Oiler	$ 45.66	31.15
GROUP 2		
Lifting devices	$ 50.82	31.15
Oiler	$ 43.11	31.15
Truck Crane Oiler	$ 45.41	31.15
GROUP 3		
Lifting devices	$ 49.14	31.15
Oiler	$ 42.89	31.15
Truck Crane Oiler	$ 45.12	31.15
GROUP 4		
Lifting devices	$ 47.37	31.15
GROUP 5		
Lifting devices	$ 44.73	31.15
GROUP 6		
Lifting devices	$ 42.50	31.15
OPERATOR: Power Equipment (Steel Erection - AREA 1:)		
GROUP 1		
Cranes	$ 53.27	31.15
Oiler	$ 43.72	31.15
Truck Crane Oiler	$ 45.95	31.15
GROUP 2		
Cranes	$ 51.50	31.15
Oiler	$ 43.45	31.15
Truck Crane Oiler	$ 45.73	31.15
GROUP 3		
Cranes	$ 50.02	31.15
Hydraulic	$ 45.07	31.15
Oiler	$ 43.23	31.15
Truck Crane Oiler	$ 45.46	31.15
GROUP 4		
Cranes	$ 48.00	31.15
GROUP 5		
Cranes	$ 46.70	31.15
OPERATOR: Power Equipment (Tunnel and Underground Work - AREA 1:)		
SHAFTS, STOPES, RAISES:		
GROUP 1	$ 56.82	31.03
GROUP 1-A	$ 59.29	31.03
GROUP 2	$ 55.56	31.03
GROUP 3	$ 54.23	31.03
GROUP 4	$ 53.09	31.03
GROUP 5	$ 51.95	31.03
UNDERGROUND:		
GROUP 1	$ 56.72	31.03
GROUP 1-A	$ 59.19	31.03
GROUP 2	$ 55.46	31.03
GROUP 3	$ 54.13	31.03

GROUP 4.....	$ 52.99	31.03
GROUP 5.....	$ 51.85	31.03

FOOTNOTE: Work suspended by ropes or cables, or work on a Yo-Yo Cat: $.60 per hour additional.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Operator of helicopter (when used in erection work); Hydraulic excavator, 7 cu. yds. and over; Power shovels, over 7 cu. yds.

GROUP 2: Highline cableway; Hydraulic excavator, 3-1/2 cu. yds. up to 7 cu. yds.; Licensed construction work boat operator, on site; Power blade operator (finish); Power shovels, over 1 cu. yd. up to and including 7 cu. yds. m.r.c.

GROUP 3: Asphalt milling machine; Cable backhoe; Combination backhoe and loader over 3/4 cu. yds.; Continuous flight tie back machine assistant to engineer or mechanic; Crane mounted continuous flight tie back machine, tonnage to apply; Crane mounted drill attachment, tonnage to apply; Dozer, slope brd; Gradall; Hydraulic excavator, up to 3 1/2 cu. yds.; Loader 4 cu. yds. and over; Long reach excavator; Multiple engine scraper (when used as push pull); Power shovels, up to and including 1 cu. yd.; Pre-stress wire wrapping machine; Side boom cat, 572 or larger; Track loader 4 cu. yds. and over; Wheel excavator (up to and including 750 cu. yds. per hour)

GROUP 4: Asphalt plant engineer/box person; Chicago boom; Combination backhoe and loader up to and including 3/4 cu. yd.; Concrete batch plant (wet or dry); Dozer and/or push cat; Pull- type elevating loader; Gradesetter, grade checker (GPS, mechanical or otherwise); Grooving and grinding machine; Heading shield operator; Heavy-duty drilling equipment, Hughes, LDH, Watson 3000 or similar; Heavy-duty repairperson and/or welder; Lime spreader; Loader under 4 cu. yds.; Lubrication and service engineer (mobile and grease rack); Mechanical finishers or spreader machine (asphalt, Barber-Greene and similar); Miller Formless M-9000 slope paver or similar; Portable crushing and screening plants; Power blade support; Roller operator, asphalt; Rubber-tired scraper, self-loading (paddle-wheels, etc.); Rubber- tired earthmoving equipment (scrapers); Slip form paver (concrete); Small tractor with drag; Soil stabilizer (P & H or equal); Spider plow and spider puller; Tubex pile rig; Unlicensed constuction work boat operator, on site; Timber skidder; Track loader up to 4 yds.; Tractor-drawn scraper; Tractor, compressor drill combination; Welder; Woods-Mixer (and other similar Pugmill equipment)

GROUP 5: Cast-in-place pipe laying machine; Combination slusher and motor operator; Concrete conveyor or concrete pump, truck or equipment mounted; Concrete conveyor, building site; Concrete pump or pumpcrete gun; Drilling

equipment, Watson 2000, Texoma 700 or similar; Drilling and boring machinery, horizontal (not to apply to waterliners, wagon drills or jackhammers); Concrete mixer/all; Person and/or material hoist; Mechanical finishers (concrete) (Clary, Johnson, Bidwell Bridge Deck or similar types); Mechanical burm, curb and/or curb and gutter machine, concrete or asphalt); Mine or shaft hoist; Portable crusher; Power jumbo operator (setting slip-forms, etc., in tunnels); Screed (automatic or manual); Self-propelled compactor with dozer; Tractor with boom D6 or smaller; Trenching machine, maximum digging capacity over 5 ft. depth; Vermeer T-600B rock cutter or similar

GROUP 6: Armor-Coater (or similar); Ballast jack tamper; Boom- type backfilling machine; Assistant plant engineer; Bridge and/or gantry crane; Chemical grouting machine, truck-mounted; Chip spreading machine operator; Concrete saw (self-propelled unit on streets, highways, airports and canals); Deck engineer; Drilling equipment Texoma 600, Hughes 200 Series or similar up to and including 30 ft. m.r.c.; Drill doctor; Helicopter radio operator; Hydro-hammer or similar; Line master; Skidsteer loader, Bobcat larger than 743 series or similar (with attachments); Locomotive; Lull hi-lift or similar; Oiler, truck mounted equipment; Pavement breaker, truck-mounted, with compressor combination; Paving fabric installation and/or laying machine; Pipe bending machine (pipelines only); Pipe wrapping machine (tractor propelled and supported); Screed (except asphaltic concrete paving); Self- propelled pipeline wrapping machine; Tractor; Self-loading chipper; Concrete barrier moving machine

GROUP 7: Ballast regulator; Boom truck or dual-purpose A-frame truck, non-rotating - under 15 tons; Cary lift or similar; Combination slurry mixer and/or cleaner; Drilling equipment, 20 ft. and under m.r.c.; Firetender (hot plant); Grouting machine operator; Highline cableway signalperson; Stationary belt loader (Kolman or similar); Lift slab machine (Vagtborg and similar types); Maginnes internal full slab vibrator; Material hoist (1 drum); Mechanical trench shield; Pavement breaker with or without compressor combination); Pipe cleaning machine (tractor propelled and supported); Post driver; Roller (except asphalt); Chip Seal; Self-propelled automatically applied concrete curing mahcine (on streets, highways, airports and canals); Self-propelled compactor (without dozer); Signalperson; Slip-form pumps (lifting device for concrete forms); Tie spacer; Tower mobile; Trenching machine, maximum digging capacity up to and including 5 ft. depth; Truck- type loader

GROUP 8: Bit sharpener; Boiler tender; Box operator; Brakeperson; Combination mixer and compressor (shotcrete/gunite); Compressor operator; Deckhand; Fire tender; Forklift (under 20 ft.); Generator; Gunite/shotcrete equipment operator; Hydraulic monitor; Ken seal machine (or similar); Mixermobile; Oiler; Pump operator; Refrigeration plant; Reservoir-debris tug (self-propelled floating); Ross Carrier (construction site); Rotomist operator; Self-propelled tape machine; Shuttlecar;

Self-propelled power sweeper operator (includes vacuum sweeper); Slusher operator; Surface heater; Switchperson; Tar pot firetender; Tugger hoist, single drum; Vacuum cooling plant; Welding machine (powered other than by electricity)

GROUP 8-A: Elevator operator; Skidsteer loader-Bobcat 743 series or smaller, and similar (without attachments); Mini excavator under 25 H.P. (backhoe-trencher); Tub grinder wood chipper

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ALL CRANES AND ATTACHMENTS

GROUP 1: Clamshell and dragline over 7 cu. yds.; Crane, over 100 tons; Derrick, over 100 tons; Derrick barge pedestal-mounted, over 100 tons; Self-propelled boom-type lifting device, over 100 tons

GROUP 2: Clamshell and dragline over 1 cu. yd. up to and including 7 cu. yds.; Crane, over 45 tons up to and including 100 tons; Derrick barge, 100 tons and under; Self-propelled boom-type lifting device, over 45 tons; Tower crane

GROUP 3: Clamshell and dragline up to and including 1 cu. yd.; Cranes 45 tons and under; Self-propelled boom-type lifting device 45 tons and under;

GROUP 4: Boom Truck or dual purpose A-frame truck, non-rotating over 15 tons; Truck-mounted rotating telescopic boom type lifting device, Manitex or similar (boom truck) over 15 tons; Truck-mounted rotating telescopic boom type lifting device, Manitex or similar (boom truck) - under 15 tons;

PILEDRIVERS

GROUP 1: Derrick barge pedestal mounted over 100 tons; Clamshell over 7 cu. yds.; Self-propelled boom-type lifting device over 100 tons; Truck crane or crawler, land or barge mounted over 100 tons

GROUP 2: Derrick barge pedestal mounted 45 tons to and including 100 tons; Clamshell up to and including 7 cu. yds.; Self-propelled boom-type lifting device over 45 tons; Truck crane or crawler, land or barge mounted, over 45 tons up to and including 100 tons; Fundex F-12 hydraulic pile rig

GROUP 3: Derrick barge pedestal mounted under 45 tons; Self-propelled boom-type lifting device 45 tons and under; Skid/scow piledriver, any tonnage; Truck crane or crawler, land or barge mounted 45 tons and under

GROUP 4: Assistant operator in lieu of assistant to engineer; Forklift, 10 tons and over; Heavy-duty repairperson/welder

GROUP 5: Deck engineer

GROUP 6: Deckhand; Fire tender

STEEL ERECTORS

GROUP 1: Crane over 100 tons; Derrick over 100 tons; Self-propelled boom-type lifting device over 100 tons

GROUP 2: Crane over 45 tons to 100 tons; Derrick under 100 tons; Self-propelled boom-type lifting device over 45 tons to 100 tons; Tower crane

GROUP 3: Crane, 45 tons and under; Self-propelled boom-type lifting device, 45 tons and under

GROUP 4: Chicago boom; Forklift, 10 tons and over; Heavy-duty repair person/welder

GROUP 5: Boom cat

TUNNEL AND UNDERGROUND WORK

GROUP 1-A: Tunnel bore machine operator, 20' diameter or more

GROUP 1: Heading shield operator; Heavy-duty repairperson; Mucking machine (rubber tired, rail or track type); Raised bore operator (tunnels); Tunnel mole bore operator

GROUP 2: Combination slusher and motor operator; Concrete pump or pumpcrete gun; Power jumbo operator

GROUP 3: Drill doctor; Mine or shaft hoist

GROUP 4: Combination slurry mixer cleaner; Grouting Machine operator; Motorman

GROUP 5: Bit Sharpener; Brakeman; Combination mixer and compressor (gunite); Compressor operator; Oiler; Pump operator; Slusher operator

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AREA DESCRIPTIONS:

POWER EQUIPMENT OPERATORS, CRANES AND ATTACHMENTS,TUNNEL AND UNDERGROUND [These areas do not apply to Piledrivers and Steel Erectors]

AREA 1: ALAMEDA, CALAVERAS, CONTRA COSTA, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, MONTEREY, SAN BENITO, SAN FRANCISCO, SAN JOAQUIN, SAN MATEO, SANTA CLARA, SANTA CRUZ, STANISLAUS, TUOLUMNE

AREA 2 -NOTED BELOW

THE REMAINING COUNTIES ARE SPLIT BETWEEN AREA 1 AND AREA 2 AS NOTED BELOW:

CALAVERAS COUNTY:
Area 1: Remainder
Area 2: Eastern Part

FRESNO COUNTY:
Area 1: Remainder
Area 2: Eastern Part

MADERA COUNTY:
Area 1: Remainder
Area 2: Eastern Part

MARIPOSA COUNTY:
Area 1: Remainder
Area 2: Eastern Part

MONTEREY COUNTY:
Area 1: Remainder
Area 2: Southwestern part

TUOLUMNE COUNTY:
Area 1: Remainder
Area 2: Eastern Part

ENGI0003-008 08/01/2024

	Rates	Fringes
Dredging: (DREDGING: CLAMSHELL & DIPPER DREDGING; HYDRAULIC SUCTION DREDGING:)		
AREA 1:		
(1) Leverman	$ 60.61	39.55
(2) Dredge Dozer; Heavy duty repairman	$ 55.65	39.55
(3) Booster Pump Operator; Deck Engineer; Deck mate; Dredge Tender; Winch Operator	$ 54.53	39.55
(4) Bargeman; Deckhand; Fireman; Leveehand; Oiler	$ 51.23	39.55
AREA 2:		
(1) Leverman	$ 62.61	39.55
(2) Dredge Dozer; Heavy duty repairman	$ 57.65	39.55
(3) Booster Pump Operator; Deck Engineer; Deck mate; Dredge Tender; Winch Operator	$ 56.53	39.55
(4) Bargeman; Deckhand; Fireman; Leveehand; Oiler	$ 53.23	39.55

AREA DESCRIPTIONS

AREA 1: ALAMEDA,BUTTE, CONTRA COSTA, KINGS, MARIN, MERCED, NAPA, SACRAMENTO, SAN BENITO, SAN FRANCISCO, SAN JOAQUIN, SAN MATEO, SANTA CLARA, SANTA CRUZ, SOLANO, STANISLAUS, SUTTER, YOLO, AND YUBA COUNTIES

AREA 2: MODOC COUNTY

THE REMAINGING COUNTIES ARE SPLIT BETWEEN AREA 1 AND AREA 2 AS NOTED BELOW:

ALPINE COUNTY:
Area 1: Northernmost part
Area 2: Remainder

CALAVERAS COUNTY:
Area 1: Remainder
Area 2: Eastern part

COLUSA COUNTY:
Area 1: Eastern part
Area 2: Remainder

ELDORADO COUNTY:
Area 1: North Central part
Area 2: Remainder

FRESNO COUNTY:
Area 1: Remainder
Area 2: Eastern part

GLENN COUNTY:
Area 1: Eastern part
Area 2: Remainder

LASSEN COUNTY:
Area 1: Western part along the Southern portion of border with Shasta County
Area 2: Remainder

MADERA COUNTY:
Area 1: Except Eastern part
Area 2: Eastern part

MARIPOSA COUNTY
Area 1: Except Eastern part
Area 2: Eastern part

MONTERREY COUNTY
Area 1: Except Southwestern part
Area 2: Southwestern part

NEVADA COUNTY:
Area 1: All but the Northern portion along the border of Sierra County
Area 2: Remainder

PLACER COUNTY:
Area 1: Al but the Central portion
Area 2: Remainder

PLUMAS COUNTY:
Area 1: Western portion
Area 2: Remainder

SHASTA COUNTY:
Area 1: All but the Northeastern corner
Area 2: Remainder

SIERRA COUNTY:
Area 1: Western part
Area 2: Remainder

SISKIYOU COUNTY:
Area 1: Central part
Area 2: Remainder

SONOMA COUNTY:
Area 1: All but the Northwestern corner
Area 2: Remainder

TEHAMA COUNTY:
Area 1: All but the Western border with Mendocino & Trinity Counties
Area 2: Remainder

TRINITY COUNTY:
Area 1: East Central part and the Northeastern border with Shasta County
Area 2: Remainder

TUOLUMNE COUNTY:
Area 1: Except Eastern part
Area 2: Eastern part

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SEE AREA DESCRIPTIONS BELOW

	Rates	Fringes
OPERATOR: Power Equipment (LANDSCAPE WORK ONLY)		
GROUP 1		
AREA 1	$ 52.40	28.52
AREA 2	$ 54.40	28.52
GROUP 2		
AREA 1	$ 48.80	28.52
AREA 2	$ 50.80	28.52
GROUP 3		
AREA 1	$ 44.19	28.52
AREA 2	$ 46.19	28.52

GROUP DESCRIPTIONS:

GROUP 1: Landscape Finish Grade Operator: All finish grade work regardless of equipment used, and all equipment with a rating more than 65 HP.

GROUP 2: Landscape Operator up to 65 HP: All equipment with a manufacturer's rating of 65 HP or less except equipment covered by Group 1 or Group 3. The following equipment shall be included except when used for finish work as long as manufacturer's rating is 65 HP or less: A-Frame and Winch Truck, Backhoe, Forklift, Hydragraphic Seeder Machine, Roller, Rubber-Tired and Track Earthmoving Equipment, Skiploader, Straw Blowers, and Trencher 31 HP up to 65 HP.

GROUP 3: Landscae Utility Operator: Small Rubber-Tired Tractor, Trencher Under 31 HP.

AREA DESCRIPTIONS:

AREA 1: ALAMEDA, BUTTE, CONTRA COSTA, KINGS, MARIN, MERCED, NAPA, SACRAMENTO, SAN BENITO, SAN FRANCISCO, SAN JOAQUIN, SAN MATEO, SANTA CLARA, SANTA CRUZ, SOLANO, STANISLAUS, SUTTER, YOLO, AND YUBA COUNTIES

AREA 2 - MODOC COUNTY

THE REMAINING COUNTIES ARE SPLIT BETWEEN AREA 1 AND AREA 2 AS NOTED BELOW:

ALPINE COUNTY:
Area 1: Northernmost part
Area 2: Remainder

CALAVERAS COUNTY:
Area 1: Except Eastern part
Area 2: Eastern part

COLUSA COUNTY:
Area 1: Eastern part
Area 2: Remainder

DEL NORTE COUNTY:
Area 1: Extreme Southwestern corner
Area 2: Remainder

ELDORADO COUNTY:
Area 1: North Central part
Area 2: Remainder

FRESNO COUNTY
Area 1: Except Eastern part
Area 2: Eastern part

GLENN COUNTY:
Area 1: Eastern part
Area 2: Remainder

HUMBOLDT COUNTY:
Area 1: Except Eastern and Southwestern parts

Area 2: Remainder

LAKE COUNTY:
Area 1: Southern part
Area 2: Remainder

LASSEN COUNTY:
Area 1: Western part along the Southern portion of border with Shasta County
Area 2: Remainder

MADERA COUNTY
Area 1: Remainder
Area 2: Eastern part

MARIPOSA COUNTY
Area 1: Remainder
Area 2: Eastern part

MENDOCINO COUNTY:
Area 1: Central and Southeastern parts
Area 2: Remainder

MONTEREY COUNTY
Area 1: Remainder
Area 2: Southwestern part

NEVADA COUNTY:
Area 1: All but the Northern portion along the border of Sierra County
Area 2: Remainder

PLACER COUNTY:
Area 1: All but the Central portion
Area 2: Remainder

PLUMAS COUNTY:
Area 1: Western portion
Area 2: Remainder

SHASTA COUNTY:
Area 1: All but the Northeastern corner
Area 2: Remainder

SIERRA COUNTY:
Area 1: Western part
Area 2: Remainder

SISKIYOU COUNTY:
Area 1: Central part
Area 2: Remainder

SONOMA COUNTY:
Area 1: All but the Northwestern corner
Area 2: Reaminder

TEHAMA COUNTY:
Area 1: All but the Western border with mendocino & Trinity Counties

Area 2: Remainder

TRINITY COUNTY:
  Area 1: East Central part and the Northeaster border with
  Shasta County
Area 2: Remainder

TULARE COUNTY;
Area 1: Remainder
Area 2: Eastern part

TUOLUMNE COUNTY:
Area 1: Remainder
Area 2: Eastern Part

IRON0377-001 01/01/2024

ALAMEDA, CONTRA COSTA, SAN MATEO, SANTA CLARA COUNTIES

	Rates	Fringes
Ironworkers:		
Fence Erector	$ 42.53	26.26
Ornamental, Reinforcing and Structural	$ 52.08	34.90

PREMIUM PAY:

$6.00 additional per hour at the following locations:

China Lake Naval Test Station, Chocolate Mountains Naval Reserve-Niland,
Edwards AFB, Fort Irwin Military Station, Fort Irwin Training Center-Goldstone, San Clemente Island, San Nicholas Island, Susanville Federal Prison, 29 Palms - Marine Corps, U.S. Marine Base - Barstow, U.S. Naval Air Facility - Sealey, Vandenberg AFB

$4.00 additional per hour at the following locations:

Army Defense Language Institute - Monterey, Fallon Air Base, Naval Post Graduate School - Monterey, Yermo Marine Corps Logistics Center

$2.00 additional per hour at the following locations:

Port Hueneme, Port Mugu, U.S. Coast Guard Station - Two Rock

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SAN FRANCISCO CITY and COUNTY

	Rates	Fringes
Ironworkers:		
Fence Erector	$ 42.53	26.26
Ornamental, Reinforcing		

and Structural.....$ 52.58		34.90

PREMIUM PAY:

$6.00 additional per hour at the following locations:

China Lake Naval Test Station, Chocolate Mountains Naval Reserve-Niland,
Edwards AFB, Fort Irwin Military Station, Fort Irwin Training Center-Goldstone, San Clemente Island, San Nicholas Island, Susanville Federal Prison, 29 Palms - Marine Corps, U.S. Marine Base - Barstow, U.S. Naval Air Facility - Sealey, Vandenberg AFB

$4.00 additional per hour at the following locations:

Army Defense Language Institute - Monterey, Fallon Air Base, Naval Post Graduate School - Monterey, Yermo Marine Corps Logistics Center

$2.00 additional per hour at the following locations:

Port Hueneme, Port Mugu, U.S. Coast Guard Station - Two Rock

IRON0433-005 01/01/2024

REMAINING COUNTIES

	Rates	Fringes
IRONWORKER		
Fence Erector.....$ 42.53		26.26
Ornamental, Reinforcing and Structural.....$ 47.45		34.90

PREMIUM PAY:

$6.00 additional per hour at the following locations:

China Lake Naval Test Station, Chocolate Mountains Naval Reserve-Niland,
Edwards AFB, Fort Irwin Military Station, Fort Irwin Training Center-Goldstone, San Clemente Island, San Nicholas Island, Susanville Federal Prison, 29 Palms - Marine Corps, U.S. Marine Base - Barstow, U.S. Naval Air Facility - Sealey, Vandenberg AFB

$4.00 additional per hour at the following locations:

Army Defense Language Institute - Monterey, Fallon Air Base, Naval Post Graduate School - Monterey, Yermo Marine Corps Logistics Center

$2.00 additional per hour at the following locations:

Port Hueneme, Port Mugu, U.S. Coast Guard Station - Two Rock

AREA ""1"" - ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO AND SANTA CLARA COUNTIES

AREA ""2"" - CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, MONTEREY, SAN BENITO, SAN JOAQUIN, STANISLAUS, AND TUOLUMNE COUNTIES

	Rates	Fringes
LABORER (ASBESTOS/MOLD/LEAD LABORER)		
Area 1	$ 37.75	29.69
Area 2	$ 36.75	29.69

ASBESTOS REMOVAL-SCOPE OF WORK: Site mobilization; initial site clean-up; site preparation; removal of asbestos-containing materials from walls and ceilings; or from pipes, boilers and mechanical systems only if they are being scrapped; encapsulation, enclosure and disposal of asbestos-containing materials by hand or with equipment or machinery; scaffolding; fabrication of temporary wooden barriers; and assembly of decontamination stations.

LABO0073-002 07/01/2023

CALAVERAS AND SAN JOAQUIN COUNTIES

	Rates	Fringes
LABORER (TRAFFIC CONTROL/LANE CLOSURE)		
Escort Driver, Flag Person	$ 36.26	27.30
Traffic Control Person I	$ 36.56	27.30
Traffic Control Person II	$ 34.06	27.30

TRAFFIC CONTROL PERSON I: Layout of traffic control, crash cushions, construction area and roadside signage.

TRAFFIC CONTROL PERSON II: Installation and removal of temporary/permanent signs, markers, delineators and crash cushions.

LABO0073-003 07/01/2023

SAN JOAQUIN COUNTY

	Rates	Fringes
LABORER		
Mason Tender-Brick	$ 36.29	25.55

LABO0073-005 06/26/2023

	Rates	Fringes

Tunnel and Shaft Laborers:

GROUP 1	$ 45.89	27.72
GROUP 2	$ 45.66	27.72
GROUP 3	$ 45.41	27.72
GROUP 4	$ 44.96	27.72
GROUP 5	$ 44.42	27.72
Shotcrete Specialist	$ 46.41	27.72

TUNNEL AND SHAFT CLASSIFICATIONS

GROUP 1: Diamond driller; Groundmen; Gunite and shotcrete nozzlemen

GROUP 2: Rodmen; Shaft work & raise (below actual or excavated ground level)

GROUP 3: Bit grinder; Blaster, driller, powdermen, heading; Cherry pickermen - where car is lifted; Concrete finisher in tunnel; Concrete screedman; Grout pumpman and potman; Gunite & shotcrete gunman & potman; Headermen; High pressure nozzleman; Miner - tunnel, including top and bottom man on shaft and raise work; Nipper; Nozzleman on slick line; Sandblaster - potman, Robotic Shotcrete Placer, Segment Erector, Tunnel Muck Hauler, Steel Form raiser and setter; Timberman, retimberman (wood or steel or substitute materials therefore); Tugger (for tunnel laborer work); Cable tender; Chuck tender; Powderman - primer house

GROUP 4: Vibrator operator, pavement breaker; Bull gang - muckers, trackmen; Concrete crew - includes rodding and spreading, Dumpmen (any method)

GROUP 5: Grout crew; Reboundman; Swamper/ Brakeman

LABO0073-007 06/26/2023

CALAVERAS AND SAN JOAQUIN COUNTIES

	Rates	Fringes
LABORER (CONSTRUCTION CRAFT LABORERS)		
Construction Specialist Group	$ 36.20	27.30
GROUP 1	$ 35.50	27.30
GROUP 1-a	$ 35.72	27.30
GROUP 1-c	$ 35.55	27.30
GROUP 1-e	$ 36.05	27.30
GROUP 1-f	$ 30.37	23.20
GROUP 2	$ 35.35	27.30
GROUP 3	$ 35.25	27.30
GROUP 4	$ 28.94	27.30
See groups 1-b and 1-d under laborer classifications.		
LABORER (GARDENERS, HORTICULTURAL & LANDSCAPE LABORERS)		
(1) New Construction	$ 35.25	27.30

(2) Establishment Warranty Period	$ 28.94	27.30
LABORER (GUNITE)		
GROUP 1	$ 36.46	27.30
GROUP 2	$ 35.96	27.30
GROUP 3	$ 35.37	27.30
GROUP 4	$ 35.25	27.30
LABORER (WRECKING)		
GROUP 1	$ 35.50	27.30
GROUP 2	$ 35.35	27.30

FOOTNOTES:
Laborers working off or with or from bos'n chairs, swinging scaffolds, belts shall receive $0.25 per hour above the applicable wage rate. This shall not apply to workers entitled to receive the wage rate set forth in Group 1-a below.

LABORER CLASSIFICATIONS

CONSTRUCTION SPECIALIST GROUP: Asphalt ironer and raker; Chainsaw; Laser beam in connection with laborers' work; Cast-in- place manhole form setter; Pressure pipelayer; Davis trencher - 300 or similar type (and all small trenchers); Blaster; Diamond driller; Multiple unit drill; Hydraulic drill

GROUP 1: Asphalt spreader boxes (all types); Barko, Wacker and similar type tampers; Buggymobile; Caulker, bander, pipewrapper, conduit layer, plastic pipelayer; Certified hazardous waste worker including Leade Abatement; Compactors of all types; Concrete and magnesite mixer, 1/2 yd. and under; Concrete pan work; Concrete sander; Concrete saw; Cribber and/or shoring; Cut granite curb setter; Dri-pak-it machine; Faller, logloader and bucker; Form raiser, slip forms; Green cutter; Headerboard, Hubsetter, aligner, by any method; High pressure blow pipe (1-1/2"" or over, 100 lbs. pressure/over); Hydro seeder and similar type; Jackhammer operator; Jacking of pipe over 12 inches; Jackson and similar type compactor; Kettle tender, pot and worker applying asphalt, lay-kold, creosote, lime, caustic and similar type materials (applying means applying, dipping or handling of such materials); Lagging, sheeting, whaling, bracing, trenchjacking, lagging hammer; Magnesite, epoxyresin, fiberglass, mastic worker (wet or dry); No joint pipe and stripping of same, including repair of voids; Pavement breaker and spader, including tool grinder; Perma curb; Pipelayer (including grade checking in connection with pipelaying); Precast-manhole setter; Pressure pipe tester; Post hole digger, air, gas and electric; Power broom sweeper; Power tampers of all types (except as shown in Group 2); Ram set gun and stud gun; Riprap stonepaver and rock-slinger, including placing of sacked concrete and/or sand (wet or dry) and gabions and similar type; Rotary scarifier or multiple head concrete chipping scarifier; Roto and Ditch Witch; Rototiller;

Sandblaster, pot, gun, nozzle operators; Signalling and rigging; Tank cleaner; Tree climber; Turbo blaster; Vibrascreed, bull float in connection with laborers' work; Vibrator; Hazardous waste worker (lead removal); Asbestos and mold removal worker

GROUP 1-a: Joy drill model TWM-2A; Gardner-Denver model DH143 and similar type drills; Track driller; Jack leg driller; Wagon driller; Mechanical drillers, all types regardless of type or method of power; Mechanical pipe layers, all types regardless of type or method of power; Blaster and powder; All work of loading, placing and blasting of all powder and explosives of whatever type regardless of method used for such loading and placing; High scalers (including drilling of same); Tree topper; Bit grinder

GROUP 1-b: Sewer cleaners shall receive $4.00 per day above Group 1 wage rates. ""Sewer cleaner"" means any worker who handles or comes in contact with raw sewage in small diameter sewers. Those who work inside recently active, large diameter sewers, and all recently active sewer manholes shal receive $5.00 per day above Group 1 wage rates.

GROUP 1-c: Burning and welding in connection with laborers' work; Synthetic thermoplastics and similar type welding

GROUP 1-d: Maintenance and repair track and road beds. All employees performing work covered herein shall receive $ .25 per hour above their regular rate for all work performed on underground structures not specifically covered herein. This paragraph shall not be construed to apply to work below ground level in open cut. It shall apply to cut and cover work of subway construction after the temporary cover has been placed.

GROUP 1-e: Work on and/or in bell hole footings and shafts thereof, and work on and in deep footings. (A deep footing is a hole 15 feet or more in depth.) In the event the depth of the footing is unknown at the commencement of excavation, and the final depth exceeds 15 feet, the deep footing wage rate would apply to all employees for each and every day worked on or in the excavation of the footing from the date of inception.

GROUP 1-f: Wire winding machine in connection with guniting or shot crete

GROUP 2: Asphalt shoveler; Cement dumper and handling dry cement or gypsum; Choke-setter and rigger (clearing work); Concrete bucket dumper and chute; Concrete chipping and grinding; Concrete laborer (wet or dry); Driller tender, chuck tender, nipper; Guinea chaser (stake), grout crew; High pressure nozzle, adductor; Hydraulic monitor (over 100 lbs. pressure); Loading and unloading, carrying and hauling of all rods and materials for use in reinforcing concrete construction; Pittsburgh chipper and similar type brush shredders; Sloper; Single foot, hand-held, pneumatic tamper; All pneumatic, air, gas and electric tools not

listed in Groups 1 through 1-f; Jacking of pipe - under 12 inches

GROUP 3: Construction laborers, including bridge and general laborer; Dump, load spotter; Flag person; Fire watcher; Fence erector; Guardrail erector; Gardener, horticultural and landscape laborer; Jetting; Limber, brush loader and piler; Pavement marker (button setter); Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Tool room attendant (jobsite only)

GROUP 4: Final clean-up work of debris, grounds and building including but not limited to: street cleaner; cleaning and washing windows; brick cleaner (jobsite only); material cleaner (jobsite only). The classification ""material cleaner"" is to be utilized under the following conditions:
A: at demolition site for the salvage of the material.
B: at the conclusion of a job where the material is to be salvaged and stocked to be reused on another job.
C: for the cleaning of salvage material at the jobsite or temporary jobsite yard.

The material cleaner classification should not be used in the performance of ""form stripping, cleaning and oiling and moving to the next point of erection"".

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural Nozzleman

GROUP 2: Nozzleman, Gunman, Potman, Groundman

GROUP 3: Reboundman

GROUP 4: Gunite laborer

WRECKING WORK LABORER CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash, windows and materials)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

LABO0073-009 07/01/2023

CALAVERAS AND SAN JOAQUIN COUNTIES

	Rates	Fringes
LABORER (Plaster Tender).....	$ 39.77	28.54

Work on a swing stage scaffold: $1.00 per hour additional.

LABO0261-003 07/01/2023

SAN FRANCISCO AND SAN MATEO COUNTIES

	Rates	Fringes
LABORER (TRAFFIC CONTROL/LANE CLOSURE)		
Escort Driver, Flag Person	$ 37.26	27.30
Traffic Control Person I	$ 37.56	27.30
Traffic Control Person II	$ 35.06	27.30

TRAFFIC CONTROL PERSON I: Layout of traffic control, crash cushions, construction area and roadside signage.

TRAFFIC CONTROL PERSON II: Installation and removal of temporary/permanent signs, markers, delineators and crash cushions.

LABO0261-005 06/26/2023

SAN FRANCISCO AND SAN MATEO COUNTIES

	Rates	Fringes
Tunnel and Shaft Laborers:		
GROUP 1	$ 45.89	27.72
GROUP 2	$ 45.66	27.72
GROUP 3	$ 45.41	27.72
GROUP 4	$ 44.96	27.72
GROUP 5	$ 44.42	27.72
Shotcrete Specialist	$ 46.41	27.72

TUNNEL AND SHAFT CLASSIFICATIONS

GROUP 1: Diamond driller; Groundmen; Gunite and shotcrete nozzlemen

GROUP 2: Rodmen; Shaft work & raise (below actual or excavated ground level)

GROUP 3: Bit grinder; Blaster, driller, powdermen, heading; Cherry pickermen - where car is lifted; Concrete finisher in tunnel; Concrete screedman; Grout pumpman and potman; Gunite & shotcrete gunman & potman; Headermen; High pressure nozzleman; Miner - tunnel, including top and bottom man on shaft and raise work; Nipper; Nozzleman on slick line; Sandblaster - potman, Robotic Shotcrete Placer, Segment Erector, Tunnel Muck Hauler, Steel Form raiser and setter; Timberman, retimberman (wood or steel or substitute materials therefore); Tugger (for tunnel laborer work); Cable tender; Chuck tender; Powderman - primer house

GROUP 4: Vibrator operator, pavement breaker; Bull gang - muckers, trackmen; Concrete crew - includes rodding and spreading, Dumpmen (any method)

GROUP 5: Grout crew; Reboundman; Swamper/ Brakeman

LABO0261-009 06/26/2023

SAN FRANCISCO, AND SAN MATEO COUNTIES

	Rates	Fringes
LABORER (CONSTRUCTION CRAFT LABORERS - AREA A:)		
Construction Specialist Group	$ 37.20	27.30
GROUP 1	$ 36.50	27.30
GROUP 1-a	$ 36.72	27.30
GROUP 1-c	$ 36.55	27.30
GROUP 1-e	$ 37.05	27.30
GROUP 1-f	$ 31.37	23.20
GROUP 2	$ 36.35	27.30
GROUP 3	$ 36.25	27.30
GROUP 4	$ 29.94	27.30
See groups 1-b and 1-d under laborer classifications.		
LABORER (GARDENERS, HORTICULTURAL & LANDSCAPE LABORERS - AREA A:)		
(1) New Construction	$ 36.25	27.30
(2) Establishment Warranty Period	$ 29.94	27.30
LABORER (WRECKING - AREA A:)		
GROUP 1	$ 36.50	27.30
GROUP 2	$ 36.35	27.30
Laborers: (GUNITE - AREA A:)		
GROUP 1	$ 37.46	27.30
GROUP 2	$ 36.96	27.30
GROUP 3	$ 36.37	27.30
GROUP 4	$ 36.25	27.30

FOOTNOTES:

Laborers working off or with or from bos'n chairs, swinging scaffolds, belts shall receive $0.25 per hour above the applicable wage rate. This shall not apply to workers entitled to receive the wage rate set forth in Group 1-a below.

LABORER CLASSIFICATIONS

CONSTRUCTION SPECIALIST GROUP: Asphalt ironer and raker; Chainsaw; Laser beam in connection with laborers' work; Cast-in- place manhole form setter; Pressure pipelayer; Davis trencher - 300 or similar type (and all small trenchers); Blaster; Diamond driller; Multiple unit drill; Hydraulic drill

GROUP 1: Asphalt spreader boxes (all types); Barko, Wacker and similar type tampers; Buggymobile; Caulker, bander, pipewrapper, conduit layer, plastic pipelayer; Certified

hazardous waste worker including Leade Abatement; Compactors of all types; Concrete and magnesite mixer, 1/2 yd. and under; Concrete pan work; Concrete sander; Concrete saw; Cribber and/or shoring; Cut granite curb setter; Dri-pak-it machine; Faller, logloader and bucker; Form raiser, slip forms; Green cutter; Headerboard, Hubsetter, aligner, by any method; High pressure blow pipe (1-1/2"" or over, 100 lbs. pressure/over); Hydro seeder and similar type; Jackhammer operator; Jacking of pipe over 12 inches; Jackson and similar type compactor; Kettle tender, pot and worker applying asphalt, lay-kold, creosote, lime, caustic and similar type materials (applying means applying, dipping or handling of such materials); Lagging, sheeting, whaling, bracing, trenchjacking, lagging hammer; Magnesite, epoxyresin, fiberglass, mastic worker (wet or dry); No joint pipe and stripping of same, including repair of voids; Pavement breaker and spader, including tool grinder; Perma curb; Pipelayer (including grade checking in connection with pipelaying); Precast-manhole setter; Pressure pipe tester; Post hole digger, air, gas and electric; Power broom sweeper; Power tampers of all types (except as shown in Group 2); Ram set gun and stud gun; Riprap stonepaver and rock-slinger, including placing of sacked concrete and/or sand (wet or dry) and gabions and similar type; Rotary scarifier or multiple head concrete chipping scarifier; Roto and Ditch Witch; Rototiller; Sandblaster, pot, gun, nozzle operators; Signalling and rigging; Tank cleaner; Tree climber; Turbo blaster; Vibrascreed, bull float in connection with laborers' work; Vibrator; Hazardous waste worker (lead removal); Asbestos and mold removal worker

GROUP 1-a: Joy drill model TWM-2A; Gardner-Denver model DH143 and similar type drills; Track driller; Jack leg driller; Wagon driller; Mechanical drillers, all types regardless of type or method of power; Mechanical pipe layers, all types regardless of type or method of power; Blaster and powder; All work of loading, placing and blasting of all powder and explosives of whatever type regardless of method used for such loading and placing; High scalers (including drilling of same); Tree topper; Bit grinder

GROUP 1-b: Sewer cleaners shall receive $4.00 per day above Group 1 wage rates. ""Sewer cleaner"" means any worker who handles or comes in contact with raw sewage in small diameter sewers. Those who work inside recently active, large diameter sewers, and all recently active sewer manholes shal receive $5.00 per day above Group 1 wage rates.

GROUP 1-c: Burning and welding in connection with laborers' work; Synthetic thermoplastics and similar type welding

GROUP 1-d: Maintenance and repair track and road beds. All employees performing work covered herein shall receive $ .25 per hour above their regular rate for all work performed on underground structures not specifically covered herein. This paragraph shall not be construed to apply to work below ground level in open cut. It shall

apply to cut and cover work of subway construction after the temporary cover has been placed.

GROUP 1-e: Work on and/or in bell hole footings and shafts thereof, and work on and in deep footings. (A deep footing is a hole 15 feet or more in depth.) In the event the depth of the footing is unknown at the commencement of excavation, and the final depth exceeds 15 feet, the deep footing wage rate would apply to all employees for each and every day worked on or in the excavation of the footing from the date of inception.

GROUP 1-f: Wire winding machine in connection with guniting or shot crete

GROUP 2: Asphalt shoveler; Cement dumper and handling dry cement or gypsum; Choke-setter and rigger (clearing work); Concrete bucket dumper and chute; Concrete chipping and grinding; Concrete laborer (wet or dry); Driller tender, chuck tender, nipper; Guinea chaser (stake), grout crew; High pressure nozzle, adductor; Hydraulic monitor (over 100 lbs. pressure); Loading and unloading, carrying and hauling of all rods and materials for use in reinforcing concrete construction; Pittsburgh chipper and similar type brush shredders; Sloper; Single foot, hand-held, pneumatic tamper; All pneumatic, air, gas and electric tools not listed in Groups 1 through 1-f; Jacking of pipe - under 12 inches

GROUP 3: Construction laborers, including bridge and general laborer; Dump, load spotter; Flag person; Fire watcher; Fence erector; Guardrail erector; Gardener, horticultural and landscape laborer; Jetting; Limber, brush loader and piler; Pavement marker (button setter); Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Tool room attendant (jobsite only)

GROUP 4: Final clean-up work of debris, grounds and building including but not limited to: street cleaner; cleaning and washing windows; brick cleaner (jobsite only); material cleaner (jobsite only). The classification ""material cleaner"" is to be utilized under the following conditions:
A: at demolition site for the salvage of the material.
B: at the conclusion of a job where the material is to be salvaged and stocked to be reused on another job.
C: for the cleaning of salvage material at the jobsite or temporary jobsite yard.

The material cleaner classification should not be used in the performance of ""form stripping, cleaning and oiling and moving to the next point of erection"".

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural Nozzleman

GROUP 2: Nozzleman, Gunman, Potman, Groundman

GROUP 3: Reboundman

GROUP 4: Gunite laborer

WRECKING WORK LABORER CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash, windows and materials)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

LABO0261-011 07/01/2023

SAN FRANCISCO AND SAN MATEO COUNTIES:

	Rates	Fringes
MASON TENDER, BRICK	$ 37.05	27.45

FOOTNOTES: Underground work such as sewers, manholes, catch basins, sewer pipes, telephone conduits, tunnels and cut trenches: $5.00 per day additional. Work in live sewage: $2.50 per day additional.

LABO0261-014 07/01/2023

SAN FRANCISCO AND SAN MATEO COUNTIES:

	Rates	Fringes
PLASTER TENDER	$ 41.93	30.32

Work on a swing stage scaffold: $1.00 per hour additional.

LABO0270-003 07/01/2023

AREA A: SANTA CLARA

AREA B: MONTEREY, SAN BENITO AND SANTA CRUZ COUNTIES

	Rates	Fringes
LABORER (TRAFFIC CONTROL/LANE CLOSURE)		
Escort Driver, Flag Person		
Area A	$ 37.26	27.30
Area B	$ 36.26	27.30
Traffic Control Person I		
Area A	$ 37.56	27.30
Area B	$ 36.56	27.30
Traffic Control Person II		

Area A.....$	35.06	27.30
Area B.....$	34.06	27.30

TRAFFIC CONTROL PERSON I: Layout of traffic control, crash cushions, construction area and roadside signage.

TRAFFIC CONTROL PERSON II: Installation and removal of temporary/permanent signs, markers, delineators and crash cushions.

LABO0270-004 06/26/2023

MONTEREY, SAN BENITO, SANTA CLARA, AND SANTA CRUZ COUNTIES

	Rates	Fringes
Tunnel and Shaft Laborers:		
GROUP 1.....$	45.89	27.72
GROUP 2.....$	45.66	27.72
GROUP 3.....$	45.41	27.72
GROUP 4.....$	44.96	27.72
GROUP 5.....$	44.42	27.72
Shotcrete Specialist.....$	46.41	27.72

TUNNEL AND SHAFT CLASSIFICATIONS

GROUP 1: Diamond driller; Groundmen; Gunite and shotcrete nozzlemen

GROUP 2: Rodmen; Shaft work & raise (below actual or excavated ground level)

GROUP 3: Bit grinder; Blaster, driller, powdermen, heading; Cherry pickermen - where car is lifted; Concrete finisher in tunnel; Concrete screedman; Grout pumpman and potman; Gunite & shotcrete gunman & potman; Headermen; High pressure nozzleman; Miner - tunnel, including top and bottom man on shaft and raise work; Nipper; Nozzleman on slick line; Sandblaster - potman, Robotic Shotcrete Placer, Segment Erector, Tunnel Muck Hauler, Steel Form raiser and setter; Timberman, retimberman (wood or steel or substitute materials therefore); Tugger (for tunnel laborer work); Cable tender; Chuck tender; Powderman - primer house

GROUP 4: Vibrator operator, pavement breaker; Bull gang - muckers, trackmen; Concrete crew - includes rodding and spreading, Dumpmen (any method)

GROUP 5: Grout crew; Reboundman; Swamper/ Brakeman

LABO0270-005 07/01/2023

MONTEREY AND SAN BENITO COUNTIES

	Rates	Fringes
LABORER		

Mason Tender-Brick	$ 36.29	25.55

LABO0270-007 06/26/2023

MONTEREY, SAN BENITO AND SANTA CRUZ COUNTIES

	Rates	Fringes
LABORER (CONSTRUCTION CRAFT LABORERS - AREA B)		
Construction Specialist Group	$ 36.20	27.30
GROUP 1	$ 35.50	27.30
GROUP 1-a	$ 35.72	27.30
GROUP 1-c	$ 35.55	27.30
GROUP 1-e	$ 36.05	27.30
GROUP 1-f	$ 36.08	27.30
GROUP 2	$ 35.35	27.30
GROUP 3	$ 35.25	27.30
GROUP 4	$ 28.94	27.30
See groups 1-b and 1-d under laborer classifications.		
LABORER (GARDENERS, HORTICULTURAL & LANDSCAPE LABORERS - AREA B)		
(1) New Construction	$ 35.25	27.30
(2) Establishment Warranty Period	$ 28.94	27.30
LABORER (GUNITE - AREA B)		
GROUP 1	$ 36.46	27.30
GROUP 2	$ 35.96	27.30
GROUP 3	$ 35.37	27.30
GROUP 4	$ 35.25	27.30
LABORER (WRECKING - AREA B)		
GROUP 1	$ 35.50	27.30
GROUP 2	$ 35.35	27.30

FOOTNOTES:

Laborers working off or with or from bos'n chairs, swinging scaffolds, belts shall receive $0.25 per hour above the applicable wage rate. This shall not apply to workers entitled to receive the wage rate set forth in Group 1-a below.

LABORER CLASSIFICATIONS

CONSTRUCTION SPECIALIST GROUP: Asphalt ironer and raker; Chainsaw; Laser beam in connection with laborers' work; Cast-in- place manhole form setter; Pressure pipelayer; Davis trencher - 300 or similar type (and all small trenchers); Blaster; Diamond driller; Multiple unit drill; Hydraulic drill

GROUP 1: Asphalt spreader boxes (all types); Barko, Wacker and similar type tampers; Buggymobile; Caulker, bander, pipewrapper, conduit layer, plastic pipelayer; Certified hazardous waste worker including Leade Abatement;

Compactors of all types; Concrete and magnesite mixer, 1/2 yd. and under; Concrete pan work; Concrete sander; Concrete saw; Cribber and/or shoring; Cut granite curb setter; Dri-pak-it machine; Faller, logloader and bucker; Form raiser, slip forms; Green cutter; Headerboard, Hubsetter, aligner, by any method; High pressure blow pipe (1-1/2"" or over, 100 lbs. pressure/over); Hydro seeder and similar type; Jackhammer operator; Jacking of pipe over 12 inches; Jackson and similar type compactor; Kettle tender, pot and worker applying asphalt, lay-kold, creosote, lime, caustic and similar type materials (applying means applying, dipping or handling of such materials); Lagging, sheeting, whaling, bracing, trenchjacking, lagging hammer; Magnesite, epoxyresin, fiberglass, mastic worker (wet or dry); No joint pipe and stripping of same, including repair of voids; Pavement breaker and spader, including tool grinder; Perma curb; Pipelayer (including grade checking in connection with pipelaying); Precast-manhole setter; Pressure pipe tester; Post hole digger, air, gas and electric; Power broom sweeper; Power tampers of all types (except as shown in Group 2); Ram set gun and stud gun; Riprap stonepaver and rock-slinger, including placing of sacked concrete and/or sand (wet or dry) and gabions and similar type; Rotary scarifier or multiple head concrete chipping scarifier; Roto and Ditch Witch; Rototiller; Sandblaster, pot, gun, nozzle operators; Signalling and rigging; Tank cleaner; Tree climber; Turbo blaster; Vibrascreed, bull float in connection with laborers' work; Vibrator; Hazardous waste worker (lead removal); Asbestos and mold removal worker

GROUP 1-a: Joy drill model TWM-2A; Gardner-Denver model DH143 and similar type drills; Track driller; Jack leg driller; Wagon driller; Mechanical drillers, all types regardless of type or method of power; Mechanical pipe layers, all types regardless of type or method of power; Blaster and powder; All work of loading, placing and blasting of all powder and explosives of whatever type regardless of method used for such loading and placing; High scalers (including drilling of same); Tree topper; Bit grinder

GROUP 1-b: Sewer cleaners shall receive $4.00 per day above Group 1 wage rates. ""Sewer cleaner"" means any worker who handles or comes in contact with raw sewage in small diameter sewers. Those who work inside recently active, large diameter sewers, and all recently active sewer manholes shal receive $5.00 per day above Group 1 wage rates.

GROUP 1-c: Burning and welding in connection with laborers' work; Synthetic thermoplastics and similar type welding

GROUP 1-d: Maintenance and repair track and road beds. All employees performing work covered herein shall receive $ .25 per hour above their regular rate for all work performed on underground structures not specifically covered herein. This paragraph shall not be construed to apply to work below ground level in open cut. It shall apply to cut and cover work of subway construction after

the temporary cover has been placed.

GROUP 1-e: Work on and/or in bell hole footings and shafts thereof, and work on and in deep footings. (A deep footing is a hole 15 feet or more in depth.) In the event the depth of the footing is unknown at the commencement of excavation, and the final depth exceeds 15 feet, the deep footing wage rate would apply to all employees for each and every day worked on or in the excavation of the footing from the date of inception.

GROUP 1-f: Wire winding machine in connection with guniting or shot crete

GROUP 2: Asphalt shoveler; Cement dumper and handling dry cement or gypsum; Choke-setter and rigger (clearing work); Concrete bucket dumper and chute; Concrete chipping and grinding; Concrete laborer (wet or dry); Driller tender, chuck tender, nipper; Guinea chaser (stake), grout crew; High pressure nozzle, adductor; Hydraulic monitor (over 100 lbs. pressure); Loading and unloading, carrying and hauling of all rods and materials for use in reinforcing concrete construction; Pittsburgh chipper and similar type brush shredders; Sloper; Single foot, hand-held, pneumatic tamper; All pneumatic, air, gas and electric tools not listed in Groups 1 through 1-f; Jacking of pipe - under 12 inches

GROUP 3: Construction laborers, including bridge and general laborer; Dump, load spotter; Flag person; Fire watcher; Fence erector; Guardrail erector; Gardener, horticultural and landscape laborer; Jetting; Limber, brush loader and piler; Pavement marker (button setter); Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Tool room attendant (jobsite only)

GROUP 4: Final clean-up work of debris, grounds and building including but not limited to: street cleaner; cleaning and washing windows; brick cleaner (jobsite only); material cleaner (jobsite only). The classification ""material cleaner"" is to be utilized under the following conditions:
A: at demolition site for the salvage of the material.
B: at the conclusion of a job where the material is to be salvaged and stocked to be reused on another job.
C: for the cleaning of salvage material at the jobsite or temporary jobsite yard.

The material cleaner classification should not be used in the performance of ""form stripping, cleaning and oiling and moving to the next point of erection"".

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural Nozzleman

GROUP 2: Nozzleman, Gunman, Potman, Groundman

GROUP 3: Reboundman

GROUP 4: Gunite laborer

WRECKING WORK LABORER CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash, windows and materials)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

LABO0270-010 06/26/2023

SANTA CLARA COUNTY

	Rates	Fringes
LABORER (CONSTRUCTION CRAFT LABORERS - AREA A:)		
Construction Specialist Group	$ 37.20	27.30
GROUP 1	$ 36.50	27.30
GROUP 1-a	$ 36.72	27.30
GROUP 1-c	$ 36.55	27.30
GROUP 1-e	$ 37.05	27.30
GROUP 1-f	$ 37.08	27.30
GROUP 2	$ 36.35	27.30
GROUP 3	$ 36.25	27.30
GROUP 4	$ 29.94	27.30
See groups 1-b and 1-d under laborer classifications.		
LABORER (GARDENERS, HORTICULTURAL & LANDSCAPE LABORERS - AREA A:)		
(1) New Construction	$ 36.25	27.30
(2) Establishment Warranty Period	$ 29.94	27.30
LABORER (GUNITE - AREA A:)		
GROUP 1	$ 37.46	27.30
GROUP 2	$ 36.96	27.30
GROUP 3	$ 36.37	27.30
GROUP 4	$ 36.25	27.30
LABORER (WRECKING - AREA A:)		
GROUP 1	$ 36.50	27.30
GROUP 2	$ 36.35	27.30

FOOTNOTES:

Laborers working off or with or from bos'n chairs, swinging scaffolds, belts shall receive $0.25 per hour above the applicable wage rate. This shall not apply to workers entitled to receive the wage rate set forth in Group 1-a below.

LABORER CLASSIFICATIONS

CONSTRUCTION SPECIALIST GROUP: Asphalt ironer and raker; Chainsaw; Laser beam in connection with laborers' work; Cast-in- place manhole form setter; Pressure pipelayer; Davis trencher - 300 or similar type (and all small trenchers); Blaster; Diamond driller; Multiple unit drill; Hydraulic drill

GROUP 1: Asphalt spreader boxes (all types); Barko, Wacker and similar type tampers; Buggymobile; Caulker, bander, pipewrapper, conduit layer, plastic pipelayer; Certified hazardous waste worker including Leade Abatement; Compactors of all types; Concrete and magnesite mixer, 1/2 yd. and under; Concrete pan work; Concrete sander; Concrete saw; Cribber and/or shoring; Cut granite curb setter; Dri-pak-it machine; Faller, logloader and bucker; Form raiser, slip forms; Green cutter; Headerboard, Hubsetter, aligner, by any method; High pressure blow pipe (1-1/2"" or over, 100 lbs. pressure/over); Hydro seeder and similar type; Jackhammer operator; Jacking of pipe over 12 inches; Jackson and similar type compactor; Kettle tender, pot and worker applying asphalt, lay-kold, creosote, lime, caustic and similar type materials (applying means applying, dipping or handling of such materials); Lagging, sheeting, whaling, bracing, trenchjacking, lagging hammer; Magnesite, epoxyresin, fiberglass, mastic worker (wet or dry); No joint pipe and stripping of same, including repair of voids; Pavement breaker and spader, including tool grinder; Perma curb; Pipelayer (including grade checking in connection with pipelaying); Precast-manhole setter; Pressure pipe tester; Post hole digger, air, gas and electric; Power broom sweeper; Power tampers of all types (except as shown in Group 2); Ram set gun and stud gun; Riprap stonepaver and rock-slinger, including placing of sacked concrete and/or sand (wet or dry) and gabions and similar type; Rotary scarifier or multiple head concrete chipping scarifier; Roto and Ditch Witch; Rototiller; Sandblaster, pot, gun, nozzle operators; Signalling and rigging; Tank cleaner; Tree climber; Turbo blaster; Vibrascreed, bull float in connection with laborers' work; Vibrator; Hazardous waste worker (lead removal); Asbestos and mold removal worker

GROUP 1-a: Joy drill model TWM-2A; Gardner-Denver model DH143 and similar type drills; Track driller; Jack leg driller; Wagon driller; Mechanical drillers, all types regardless of type or method of power; Mechanical pipe layers, all types regardless of type or method of power; Blaster and powder; All work of loading, placing and blasting of all powder and explosives of whatever type regardless of method used for such loading and placing; High scalers (including drilling of same); Tree topper; Bit grinder

GROUP 1-b: Sewer cleaners shall receive $4.00 per day above Group 1 wage rates. ""Sewer cleaner"" means any worker who handles or comes in contact with raw sewage in small diameter sewers. Those who work inside recently active,

large diameter sewers, and all recently active sewer manholes shal receive $5.00 per day above Group 1 wage rates.

GROUP 1-c: Burning and welding in connection with laborers' work; Synthetic thermoplastics and similar type welding

GROUP 1-d: Maintenance and repair track and road beds. All employees performing work covered herein shall receive $ .25 per hour above their regular rate for all work performed on underground structures not specifically covered herein. This paragraph shall not be construed to apply to work below ground level in open cut. It shall apply to cut and cover work of subway construction after the temporary cover has been placed.

GROUP 1-e: Work on and/or in bell hole footings and shafts thereof, and work on and in deep footings. (A deep footing is a hole 15 feet or more in depth.) In the event the depth of the footing is unknown at the commencement of excavation, and the final depth exceeds 15 feet, the deep footing wage rate would apply to all employees for each and every day worked on or in the excavation of the footing from the date of inception.

GROUP 1-f: Wire winding machine in connection with guniting or shot crete

GROUP 2: Asphalt shoveler; Cement dumper and handling dry cement or gypsum; Choke-setter and rigger (clearing work); Concrete bucket dumper and chute; Concrete chipping and grinding; Concrete laborer (wet or dry); Driller tender, chuck tender, nipper; Guinea chaser (stake), grout crew; High pressure nozzle, adductor; Hydraulic monitor (over 100 lbs. pressure); Loading and unloading, carrying and hauling of all rods and materials for use in reinforcing concrete construction; Pittsburgh chipper and similar type brush shredders; Sloper; Single foot, hand-held, pneumatic tamper; All pneumatic, air, gas and electric tools not listed in Groups 1 through 1-f; Jacking of pipe - under 12 inches

GROUP 3: Construction laborers, including bridge and general laborer; Dump, load spotter; Flag person; Fire watcher; Fence erector; Guardrail erector; Gardener, horticultural and landscape laborer; Jetting; Limber, brush loader and piler; Pavement marker (button setter); Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Tool room attendant (jobsite only)

GROUP 4: Final clean-up work of debris, grounds and building including but not limited to: street cleaner; cleaning and washing windows; brick cleaner (jobsite only); material cleaner (jobsite only). The classification ""material cleaner"" is to be utilized under the following conditions:
A: at demolition site for the salvage of the material.
B: at the conclusion of a job where the material is to be salvaged and stocked to be reused on another job.

C: for the cleaning of salvage material at the jobsite or temporary jobsite yard.

The material cleaner classification should not be used in the performance of ""form stripping, cleaning and oiling and moving to the next point of erection"".

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural Nozzleman

GROUP 2: Nozzleman, Gunman, Potman, Groundman

GROUP 3: Reboundman

GROUP 4: Gunite laborer

WRECKING WORK LABORER CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash, windows and materials)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

LABO0270-011 07/01/2023

MONTEREY, SAN BENITO, SANTA CRUZ, SANTA CLARA COUNTIES

	Rates	Fringes
LABORER (Plaster Tender)	$ 40.68	29.68

Work on a swing stage scaffold: $1.00 per hour additional.

LABO0294-001 07/01/2023

FRESNO, KINGS AND MADERA COUNTIES

	Rates	Fringes
LABORER (Brick)		
Mason Tender-Brick	$ 36.29	25.55

LABO0294-002 07/01/2023

FRESNO, KINGS, AND MADERA COUNTIES

	Rates	Fringes
LABORER (TRAFFIC CONTROL/LANE CLOSURE)		
Escort Driver, Flag Person	$ 36.26	27.30
Traffic Control Person I	$ 36.56	27.30

Traffic Control Person II...$ 34.06 27.30

TRAFFIC CONTROL PERSON I: Layout of traffic control, crash cushions, construction area and roadside signage.

TRAFFIC CONTROL PERSON II: Installation and removal of temporary/permanent signs, markers, delineators and crash cushions.

LABO0294-005 06/26/2023

FRESNO, KINGS, AND MADERA COUNTIES

	Rates	Fringes
Tunnel and Shaft Laborers:		
GROUP 1	$ 45.89	27.72
GROUP 2	$ 45.66	27.72
GROUP 3	$ 45.41	27.72
GROUP 4	$ 44.96	27.72
GROUP 5	$ 44.42	27.72
Shotcrete Specialist	$ 46.41	27.72

TUNNEL AND SHAFT CLASSIFICATIONS

GROUP 1: Diamond driller; Groundmen; Gunite and shotcrete nozzlemen

GROUP 2: Rodmen; Shaft work & raise (below actual or excavated ground level)

GROUP 3: Bit grinder; Blaster, driller, powdermen, heading; Cherry pickermen - where car is lifted; Concrete finisher in tunnel; Concrete screedman; Grout pumpman and potman; Gunite & shotcrete gunman & potman; Headermen; High pressure nozzleman; Miner - tunnel, including top and bottom man on shaft and raise work; Nipper; Nozzleman on slick line; Sandblaster - potman, Robotic Shotcrete Placer, Segment Erector, Tunnel Muck Hauler, Steel Form raiser and setter; Timberman, retimberman (wood or steel or substitute materials therefore); Tugger (for tunnel laborer work); Cable tender; Chuck tender; Powderman - primer house

GROUP 4: Vibrator operator, pavement breaker; Bull gang - muckers, trackmen; Concrete crew - includes rodding and spreading, Dumpmen (any method)

GROUP 5: Grout crew; Reboundman; Swamper/ Brakeman

LABO0294-008 06/26/2023

FRESNO, KINGS, AND MADERA COUNTIES

	Rates	Fringes
LABORER (CONSTRUCTION CRAFT LABORERS - AREA B:)		

Construction Specialist Group	$ 36.20	27.30
GROUP 1	$ 35.50	27.30
GROUP 1-a	$ 35.72	27.30
GROUP 1-c	$ 35.55	27.30
GROUP 1-e	$ 36.05	27.30
GROUP 1-f	$ 36.08	27.30
GROUP 2	$ 35.35	27.30
GROUP 3	$ 35.25	27.30
GROUP 4	$ 28.94	27.30

See groups 1-b and 1-d under laborer classifications.

LABORER (GARDENERS, HORTICULTURAL & LANDSCAPE LABORERS - AREA B:)		
(1) New Construction	$ 35.25	27.30
(2) Establishment Warranty Period	$ 28.94	27.30
LABORER (GUNITE - AREA B:)		
GROUP 1	$ 36.46	27.30
GROUP 2	$ 35.96	27.30
GROUP 3	$ 35.37	27.30
GROUP 4	$ 35.25	27.30
LABORER (WRECKING - AREA B:)		
GROUP 1	$ 35.50	27.30
GROUP 2	$ 35.35	27.30

FOOTNOTES:

Laborers working off or with or from bos'n chairs, swinging scaffolds, belts shall receive $0.25 per hour above the applicable wage rate. This shall not apply to workers entitled to receive the wage rate set forth in Group 1-a below.

LABORER CLASSIFICATIONS

CONSTRUCTION SPECIALIST GROUP: Asphalt ironer and raker; Chainsaw; Laser beam in connection with laborers' work; Cast-in- place manhole form setter; Pressure pipelayer; Davis trencher - 300 or similar type (and all small trenchers); Blaster; Diamond driller; Multiple unit drill; Hydraulic drill

GROUP 1: Asphalt spreader boxes (all types); Barko, Wacker and similar type tampers; Buggymobile; Caulker, bander, pipewrapper, conduit layer, plastic pipelayer; Certified hazardous waste worker including Leade Abatement; Compactors of all types; Concrete and magnesite mixer, 1/2 yd. and under; Concrete pan work; Concrete sander; Concrete saw; Cribber and/or shoring; Cut granite curb setter; Dri-pak-it machine; Faller, logloader and bucker; Form raiser, slip forms; Green cutter; Headerboard, Hubsetter, aligner, by any method; High pressure blow pipe (1-1/2"" or over, 100 lbs. pressure/over); Hydro seeder and similar type; Jackhammer operator; Jacking of pipe over 12 inches; Jackson and similar type compactor; Kettle tender, pot and worker applying asphalt, lay-kold, creosote, lime, caustic

and similar type materials (applying means applying, dipping or handling of such materials); Lagging, sheeting, whaling, bracing, trenchjacking, lagging hammer; Magnesite, epoxyresin, fiberglass, mastic worker (wet or dry); No joint pipe and stripping of same, including repair of voids; Pavement breaker and spader, including tool grinder; Perma curb; Pipelayer (including grade checking in connection with pipelaying); Precast-manhole setter; Pressure pipe tester; Post hole digger, air, gas and electric; Power broom sweeper; Power tampers of all types (except as shown in Group 2); Ram set gun and stud gun; Riprap stonepaver and rock-slinger, including placing of sacked concrete and/or sand (wet or dry) and gabions and similar type; Rotary scarifier or multiple head concrete chipping scarifier; Roto and Ditch Witch; Rototiller; Sandblaster, pot, gun, nozzle operators; Signalling and rigging; Tank cleaner; Tree climber; Turbo blaster; Vibrascreed, bull float in connection with laborers' work; Vibrator; Hazardous waste worker (lead removal); Asbestos and mold removal worker

GROUP 1-a: Joy drill model TWM-2A; Gardner-Denver model DH143 and similar type drills; Track driller; Jack leg driller; Wagon driller; Mechanical drillers, all types regardless of type or method of power; Mechanical pipe layers, all types regardless of type or method of power; Blaster and powder; All work of loading, placing and blasting of all powder and explosives of whatever type regardless of method used for such loading and placing; High scalers (including drilling of same); Tree topper; Bit grinder

GROUP 1-b: Sewer cleaners shall receive $4.00 per day above Group 1 wage rates. ""Sewer cleaner"" means any worker who handles or comes in contact with raw sewage in small diameter sewers. Those who work inside recently active, large diameter sewers, and all recently active sewer manholes shal receive $5.00 per day above Group 1 wage rates.

GROUP 1-c: Burning and welding in connection with laborers' work; Synthetic thermoplastics and similar type welding

GROUP 1-d: Maintenance and repair track and road beds. All employees performing work covered herein shall receive $ .25 per hour above their regular rate for all work performed on underground structures not specifically covered herein. This paragraph shall not be construed to apply to work below ground level in open cut. It shall apply to cut and cover work of subway construction after the temporary cover has been placed.

GROUP 1-e: Work on and/or in bell hole footings and shafts thereof, and work on and in deep footings. (A deep footing is a hole 15 feet or more in depth.) In the event the depth of the footing is unknown at the commencement of excavation, and the final depth exceeds 15 feet, the deep footing wage rate would apply to all employees for each and every day worked on or in the excavation of the footing from the date of inception.

GROUP 1-f: Wire winding machine in connection with guniting or shot crete

GROUP 2: Asphalt shoveler; Cement dumper and handling dry cement or gypsum; Choke-setter and rigger (clearing work); Concrete bucket dumper and chute; Concrete chipping and grinding; Concrete laborer (wet or dry); Driller tender, chuck tender, nipper; Guinea chaser (stake), grout crew; High pressure nozzle, adductor; Hydraulic monitor (over 100 lbs. pressure); Loading and unloading, carrying and hauling of all rods and materials for use in reinforcing concrete construction; Pittsburgh chipper and similar type brush shredders; Sloper; Single foot, hand-held, pneumatic tamper; All pneumatic, air, gas and electric tools not listed in Groups 1 through 1-f; Jacking of pipe - under 12 inches

GROUP 3: Construction laborers, including bridge and general laborer; Dump, load spotter; Flag person; Fire watcher; Fence erector; Guardrail erector; Gardener, horticultural and landscape laborer; Jetting; Limber, brush loader and piler; Pavement marker (button setter); Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Tool room attendant (jobsite only)

GROUP 4: Final clean-up work of debris, grounds and building including but not limited to: street cleaner; cleaning and washing windows; brick cleaner (jobsite only); material cleaner (jobsite only). The classification ""material cleaner"" is to be utilized under the following conditions:
A: at demolition site for the salvage of the material.
B: at the conclusion of a job where the material is to be salvaged and stocked to be reused on another job.
C: for the cleaning of salvage material at the jobsite or temporary jobsite yard.

The material cleaner classification should not be used in the performance of ""form stripping, cleaning and oiling and moving to the next point of erection"".

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural Nozzleman

GROUP 2: Nozzleman, Gunman, Potman, Groundman

GROUP 3: Reboundman

GROUP 4: Gunite laborer

WRECKING WORK LABORER CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash,

windows and materials)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

LABO0294-010 07/01/2023

CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS & TUOLUMNE

	Rates	Fringes
Plasterer tender	$ 39.77	28.54

Work on a swing stage scaffold: $1.00 per hour additional.

LABO0294-011 07/01/2023

FRESNO, KINGS, AND MADERA COUNTIES

	Rates	Fringes
LABORER (Plaster Tender)	$ 39.77	28.54

Work on a swing stage scaffold: $1.00 per hour additional.

LABO0304-002 07/01/2023

ALAMEDA COUNTY

	Rates	Fringes
LABORER (TRAFFIC CONTROL/LANE CLOSURE)		
Escort Driver, Flag Person	$ 37.26	27.30
Traffic Control Person I	$ 37.56	27.30
Traffic Control Person II	$ 35.06	27.30

TRAFFIC CONTROL PERSON I: Layout of traffic control, crash cushions, construction area and roadside signage.

TRAFFIC CONTROL PERSON II: Installation and removal of temporary/permanent signs, markers, delineators and crash cushions.

LABO0304-003 06/26/2023

ALAMEDA COUNTY

	Rates	Fringes
Tunnel and Shaft Laborers:		
GROUP 1	$ 45.89	27.72
GROUP 2	$ 45.66	27.72
GROUP 3	$ 45.41	27.72
GROUP 4	$ 44.96	27.72

GROUP 5	$ 44.42	27.72
Shotcrete Specialist	$ 46.41	27.72

TUNNEL AND SHAFT CLASSIFICATIONS

GROUP 1: Diamond driller; Groundmen; Gunite and shotcrete nozzlemen

GROUP 2: Rodmen; Shaft work & raise (below actual or excavated ground level)

GROUP 3: Bit grinder; Blaster, driller, powdermen, heading; Cherry pickermen - where car is lifted; Concrete finisher in tunnel; Concrete screedman; Grout pumpman and potman; Gunite & shotcrete gunman & potman; Headermen; High pressure nozzleman; Miner - tunnel, including top and bottom man on shaft and raise work; Nipper; Nozzleman on slick line; Sandblaster - potman, Robotic Shotcrete Placer, Segment Erector, Tunnel Muck Hauler, Steel Form raiser and setter; Timberman, retimberman (wood or steel or substitute materials therefore); Tugger (for tunnel laborer work); Cable tender; Chuck tender; Powderman - primer house

GROUP 4: Vibrator operator, pavement breaker; Bull gang - muckers, trackmen; Concrete crew - includes rodding and spreading, Dumpmen (any method)

GROUP 5: Grout crew; Reboundman; Swamper/ Brakeman

LABO0304-004 06/26/2023

ALAMEDA COUNTY

	Rates	Fringes
LABORER (CONSTRUCTION CRAFT LABORERS - AREA A:)		
Construction Specialist Group	$ 37.20	27.30
GROUP 1	$ 36.50	27.30
GROUP 1-a	$ 36.72	27.30
GROUP 1-c	$ 36.55	27.30
GROUP 1-e	$ 37.05	27.30
GROUP 1-f	$ 37.08	27.30
GROUP 2	$ 36.35	27.30
GROUP 3	$ 36.25	27.30
GROUP 4	$ 29.94	27.30
See groups 1-b and 1-d under laborer classifications.		
LABORER (GARDENERS, HORTICULTURAL & LANDSCAPE LABORERS - AREA A:)		
(1) New Construction	$ 36.25	27.30
(2) Establishment Warranty Period	$ 29.94	27.30
LABORER (GUNITE - AREA A:)		
GROUP 1	$ 37.46	27.30
GROUP 2	$ 36.96	27.30
GROUP 3	$ 36.37	27.30

GROUP 4	$ 36.25	27.30
LABORER (WRECKING - AREA A:)		
GROUP 1	$ 36.50	27.30
GROUP 2	$ 36.35	27.30

FOOTNOTES:
Laborers working off or with or from bos'n chairs, swinging scaffolds, belts shall receive $0.25 per hour above the applicable wage rate. This shall not apply to workers entitled to receive the wage rate set forth in Group 1-a below.

LABORER CLASSIFICATIONS

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GROUP 3: Construction laborers, including bridge and general laborer; Dump, load spotter; Flag person; Fire watcher; Fence erector; Guardrail erector; Gardener, horticultural

and landscape laborer; Jetting; Limber, brush loader and piler; Pavement marker (button setter); Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Tool room attendant (jobsite only)

GROUP 4: Final clean-up work of debris, grounds and building including but not limited to: street cleaner; cleaning and washing windows; brick cleaner (jobsite only); material cleaner (jobsite only). The classification ""material cleaner"" is to be utilized under the following conditions:
A: at demolition site for the salvage of the material.
B: at the conclusion of a job where the material is to be salvaged and stocked to be reused on another job.
C: for the cleaning of salvage material at the jobsite or temporary jobsite yard.

The material cleaner classification should not be used in the performance of ""form stripping, cleaning and oiling and moving to the next point of erection"".

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural Nozzleman

GROUP 2: Nozzleman, Gunman, Potman, Groundman

GROUP 3: Reboundman

GROUP 4: Gunite laborer

WRECKING WORK LABORER CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash, windows and materials)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

LABO0304-005 07/01/2023

ALAMEDA COUNTY

	Rates	Fringes
Brick Tender	$ 37.05	27.45

FOOTNOTES: Work on jobs where heat-protective clothing is required: $2.00 per hour additional. Work at grinders: $.25 per hour additional. Manhole work: $2.00 per day additional.

LABO0304-008 07/01/2023

ALAMEDA AND CONTRA COSTA COUNTIES:

	Rates	Fringes
Plasterer tender	$ 41.93	30.32

Work on a swing stage scaffold: $1.00 per hour additional.

LABO0324-002 07/01/2023

CONTRA COSTA COUNTY

	Rates	Fringes
LABORER (TRAFFIC CONTROL/LANE CLOSURE)		
Escort Driver, Flag Person	$ 37.26	27.30
Traffic Control Person I	$ 37.56	27.30
Traffic Control Person II	$ 35.06	27.30

TRAFFIC CONTROL PERSON I: Layout of traffic control, crash cushions, construction area and roadside signage.

TRAFFIC CONTROL PERSON II: Installation and removal of temporary/permanent signs, markers, delineators and crash cushions.

LABO0324-006 06/26/2023

CONTRA COSTA COUNTY

	Rates	Fringes
Tunnel and Shaft Laborers:		
GROUP 1	$ 45.89	27.72
GROUP 2	$ 45.66	27.72
GROUP 3	$ 45.41	27.72
GROUP 4	$ 44.96	27.72
GROUP 5	$ 44.42	27.72
Shotcrete Specialist	$ 46.41	27.72

TUNNEL AND SHAFT CLASSIFICATIONS

GROUP 1: Diamond driller; Groundmen; Gunite and shotcrete nozzlemen

GROUP 2: Rodmen; Shaft work & raise (below actual or excavated ground level)

GROUP 3: Bit grinder; Blaster, driller, powdermen, heading; Cherry pickermen - where car is lifted; Concrete finisher in tunnel; Concrete screedman; Grout pumpman and potman; Gunite & shotcrete gunman & potman; Headermen; High pressure nozzleman; Miner - tunnel, including top and bottom man on shaft and raise work; Nipper; Nozzleman on slick line; Sandblaster - potman, Robotic Shotcrete Placer, Segment Erector, Tunnel Muck Hauler, Steel Form raiser and setter; Timberman, retimberman (wood or steel or substitute

materials therefore); Tugger (for tunnel laborer work); Cable tender; Chuck tender; Powderman - primer house

GROUP 4: Vibrator operator, pavement breaker; Bull gang - muckers, trackmen; Concrete crew - includes rodding and spreading, Dumpmen (any method)

GROUP 5: Grout crew; Reboundman; Swamper/ Brakeman

LABO0324-012 06/26/2023

CONTRA COSTA COUNTY

	Rates	Fringes
LABORER (CONSTRUCTION CRAFT LABORERS - AREA A:)		
Construction Specialist Group	$ 37.20	27.30
GROUP 1	$ 36.50	27.30
GROUP 1-a	$ 36.72	27.30
GROUP 1-c	$ 36.55	27.30
GROUP 1-e	$ 37.05	27.30
GROUP 1-f	$ 37.08	27.30
GROUP 1-g	$ 36.70	27.30
GROUP 2	$ 36.35	27.30
GROUP 3	$ 36.25	27.30
GROUP 4	$ 29.94	27.30
See groups 1-b and 1-d under laborer classifications.		
LABORER (GARDENERS, HORTICULURAL & LANDSCAPE LABORERS - AREA A:)		
(1) New Construction	$ 36.25	27.30
(2) Establishment Warranty Period	$ 29.94	27.30
LABORER (GUNITE - AREA A:)		
GROUP 1	$ 37.46	27.30
GROUP 2	$ 36.96	27.30
GROUP 3	$ 36.37	27.30
GROUP 4	$ 36.25	27.30
LABORER (WRECKING - AREA A:)		
GROUP 1	$ 36.50	27.30
GROUP 2	$ 36.35	27.30

FOOTNOTES:

Laborers working off or with or from bos'n chairs, swinging scaffolds, belts shall receive $0.25 per hour above the applicable wage rate. This shall not apply to workers entitled to receive the wage rate set forth in Group 1-a below.

LABORER CLASSIFICATIONS

CONSTRUCTION SPECIALIST GROUP: Asphalt ironer and raker; Chainsaw; Laser beam in connection with laborers' work;

Cast-in- place manhole form setter; Pressure pipelayer; Davis trencher - 300 or similar type (and all small trenchers); Blaster; Diamond driller; Multiple unit drill; Hydraulic drill

GROUP 1: Asphalt spreader boxes (all types); Barko, Wacker and similar type tampers; Buggymobile; Caulker, bander, pipewrapper, conduit layer, plastic pipelayer; Certified hazardous waste worker including Leade Abatement; Compactors of all types; Concrete and magnesite mixer, 1/2 yd. and under; Concrete pan work; Concrete sander; Concrete saw; Cribber and/or shoring; Cut granite curb setter; Dri-pak-it machine; Faller, logloader and bucker; Form raiser, slip forms; Green cutter; Headerboard, Hubsetter, aligner, by any method; High pressure blow pipe (1-1/2"" or over, 100 lbs. pressure/over); Hydro seeder and similar type; Jackhammer operator; Jacking of pipe over 12 inches; Jackson and similar type compactor; Kettle tender, pot and worker applying asphalt, lay-kold, creosote, lime, caustic and similar type materials (applying means applying, dipping or handling of such materials); Lagging, sheeting, whaling, bracing, trenchjacking, lagging hammer; Magnesite, epoxyresin, fiberglass, mastic worker (wet or dry); No joint pipe and stripping of same, including repair of voids; Pavement breaker and spader, including tool grinder; Perma curb; Pipelayer (including grade checking in connection with pipelaying); Precast-manhole setter; Pressure pipe tester; Post hole digger, air, gas and electric; Power broom sweeper; Power tampers of all types (except as shown in Group 2); Ram set gun and stud gun; Riprap stonepaver and rock-slinger, including placing of sacked concrete and/or sand (wet or dry) and gabions and similar type; Rotary scarifier or multiple head concrete chipping scarifier; Roto and Ditch Witch; Rototiller; Sandblaster, pot, gun, nozzle operators; Signalling and rigging; Tank cleaner; Tree climber; Turbo blaster; Vibrascreed, bull float in connection with laborers' work; Vibrator; Hazardous waste worker (lead removal); Asbestos and mold removal worker

GROUP 1-a: Joy drill model TWM-2A; Gardner-Denver model DH143 and similar type drills; Track driller; Jack leg driller; Wagon driller; Mechanical drillers, all types regardless of type or method of power; Mechanical pipe layers, all types regardless of type or method of power; Blaster and powder; All work of loading, placing and blasting of all powder and explosives of whatever type regardless of method used for such loading and placing; High scalers (including drilling of same); Tree topper; Bit grinder

GROUP 1-b: Sewer cleaners shall receive $4.00 per day above Group 1 wage rates. ""Sewer cleaner"" means any worker who handles or comes in contact with raw sewage in small diameter sewers. Those who work inside recently active, large diameter sewers, and all recently active sewer manholes shal receive $5.00 per day above Group 1 wage rates.

GROUP 1-c: Burning and welding in connection with laborers'

work; Synthetic thermoplastics and similar type welding

GROUP 1-d: Maintenance and repair track and road beds. All employees performing work covered herein shall receive $ .25 per hour above their regular rate for all work performed on underground structures not specifically covered herein. This paragraph shall not be construed to apply to work below ground level in open cut. It shall apply to cut and cover work of subway construction after the temporary cover has been placed.

GROUP 1-e: Work on and/or in bell hole footings and shafts thereof, and work on and in deep footings. (A deep footing is a hole 15 feet or more in depth.) In the event the depth of the footing is unknown at the commencement of excavation, and the final depth exceeds 15 feet, the deep footing wage rate would apply to all employees for each and every day worked on or in the excavation of the footing from the date of inception.

GROUP 1-f: Wire winding machine in connection with guniting or shot crete

GROUP 1-g, CONTRA COSTA COUNTY: Pipelayer (including grade checking in connection with pipelaying); Caulker; Bander; Pipewrapper; Conduit layer; Plastic pipe layer; Pressure pipe tester; No joint pipe and stripping of same, including repair of voids; Precast manhole setters, cast in place manhole form setters

GROUP 2: Asphalt shoveler; Cement dumper and handling dry cement or gypsum; Choke-setter and rigger (clearing work); Concrete bucket dumper and chute; Concrete chipping and grinding; Concrete laborer (wet or dry); Driller tender, chuck tender, nipper; Guinea chaser (stake), grout crew; High pressure nozzle, adductor; Hydraulic monitor (over 100 lbs. pressure); Loading and unloading, carrying and hauling of all rods and materials for use in reinforcing concrete construction; Pittsburgh chipper and similar type brush shredders; Sloper; Single foot, hand-held, pneumatic tamper; All pneumatic, air, gas and electric tools not listed in Groups 1 through 1-f; Jacking of pipe - under 12 inches

GROUP 3: Construction laborers, including bridge and general laborer; Dump, load spotter; Flag person; Fire watcher; Fence erector; Guardrail erector; Gardener, horticultural and landscape laborer; Jetting; Limber, brush loader and piler; Pavement marker (button setter); Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Tool room attendant (jobsite only)

GROUP 4: Final clean-up work of debris, grounds and building including but not limited to: street cleaner; cleaning and washing windows; brick cleaner (jobsite only); material cleaner (jobsite only). The classification ""material cleaner"" is to be utilized under the following conditions:
A: at demolition site for the salvage of the material.

B: at the conclusion of a job where the material is to be salvaged and stocked to be reused on another job.
C: for the cleaning of salvage material at the jobsite or temporary jobsite yard.

The material cleaner classification should not be used in the performance of ""form stripping, cleaning and oiling and moving to the next point of erection"".

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural Nozzleman

GROUP 2: Nozzleman, Gunman, Potman, Groundman

GROUP 3: Reboundman

GROUP 4: Gunite laborer

WRECKING WORK LABORER CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash, windows and materials)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

GROUP 1-g, CONTRA COSTA COUNTY: Pipelayer (including grade checking in connection with pipelaying); Caulker; Bander; Pipewrapper; Conduit layer; Plastic pipe layer; Pressure pipe tester; No joint pipe and stripping of same, including repair of voids; Precast manhole setters, cast in place manhole form setters

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LABO0324-014 07/01/2023

CONTRA COSTA COUNTY:

	Rates	Fringes
Brick Tender	$ 37.05	27.45

FOOTNOTES: Work on jobs where heat-protective clothing is required: $2.00 per hour additional. Work at grinders: $.25 per hour additional. Manhole work: $2.00 per day additional.

LABO0324-018 07/01/2023

ALAMEDA AND CONTRA COSTA COUNTIES:

	Rates	Fringes

Plasterer tender.....$ 41.93 30.32

Work on a swing stage scaffold: $1.00 per hour additional.

LABO1130-002 07/01/2023

MARIPOSA, MERCED, STANISLAUS, AND TUOLUMNE COUNTIES

	Rates	Fringes
LABORER (TRAFFIC CONTROL/LANE CLOSURE)		
Escort Driver, Flag Person	$ 36.26	27.30
Traffic Control Person I	$ 36.56	27.30
Traffic Control Person II	$ 34.06	27.30

TRAFFIC CONTROL PERSON I: Layout of traffic control, crash cushions, construction area and roadside signage.

TRAFFIC CONTROL PERSON II: Installation and removal of temporary/permanent signs, markers, delineators and crash cushions.

LABO1130-003 06/26/2023

MARIPOSA, MERCED, STANISLAUS, AND TUOLUMNE COUNTIES

	Rates	Fringes
Tunnel and Shaft Laborers:		
GROUP 1	$ 45.89	27.72
GROUP 2	$ 45.66	27.72
GROUP 3	$ 45.41	27.72
GROUP 4	$ 44.96	27.72
GROUP 5	$ 44.42	27.72
Shotcrete Specialist	$ 46.41	27.72

TUNNEL AND SHAFT CLASSIFICATIONS

GROUP 1: Diamond driller; Groundmen; Gunite and shotcrete nozzlemen

GROUP 2: Rodmen; Shaft work & raise (below actual or excavated ground level)

GROUP 3: Bit grinder; Blaster, driller, powdermen, heading; Cherry pickermen - where car is lifted; Concrete finisher in tunnel; Concrete screedman; Grout pumpman and potman; Gunite & shotcrete gunman & potman; Headermen; High pressure nozzleman; Miner - tunnel, including top and bottom man on shaft and raise work; Nipper; Nozzleman on slick line; Sandblaster - potman, Robotic Shotcrete Placer, Segment Erector, Tunnel Muck Hauler, Steel Form raiser and setter; Timberman, retimberman (wood or steel or substitute materials therefore); Tugger (for tunnel laborer work); Cable tender; Chuck tender; Powderman - primer house

GROUP 4: Vibrator operator, pavement breaker; Bull gang -

muckers, trackmen; Concrete crew - includes rodding and spreading, Dumpmen (any method)

GROUP 5: Grout crew; Reboundman; Swamper/ Brakeman

LABO1130-005 07/01/2023

MARIPOSA, MERCED, STANISLAUS AND TUOLUMNE COUNTIES

	Rates	Fringes
LABORER		
Mason Tender-Brick	$ 36.29	25.55

LABO1130-007 06/26/2023

MARIPOSA, MERCED, STANISLAUS, AND TUOLUMNE , COUNTIES

	Rates	Fringes
LABORER (CONSTRUCTION CRAFT LABORERS - AREA B:)		
Construction Specialist Group	$ 36.20	27.30
GROUP 1	$ 35.50	27.30
GROUP 1-a	$ 35.72	27.30
GROUP 1-c	$ 35.55	27.30
GROUP 1-e	$ 36.05	27.30
GROUP 1-f	$ 36.08	27.30
GROUP 2	$ 35.35	27.30
GROUP 3	$ 35.25	27.30
GROUP 4	$ 28.94	27.30
See groups 1-b and 1-d under laborer classifications.		
LABORER (GARDENERS, HORTICULTURAL & LANDSCAPE LABORERS - AREA B:)		
(1) New Construction	$ 35.25	27.30
(2) Establishment Warranty Period	$ 28.94	27.30
LABORER (GUNITE - AREA B:)		
GROUP 1	$ 36.46	27.30
GROUP 2	$ 35.96	27.30
GROUP 3	$ 35.37	27.30
GROUP 4	$ 35.25	27.30
LABORER (WRECKING - AREA B:)		
GROUP 1	$ 35.50	27.30
GROUP 2	$ 35.35	27.30

FOOTNOTES:

Laborers working off or with or from bos'n chairs, swinging scaffolds, belts shall receive $0.25 per hour above the applicable wage rate. This shall not apply to workers entitled to receive the wage rate set forth in Group 1-a below.

CONSTRUCTION SPECIALIST GROUP: Asphalt ironer and raker; Chainsaw; Laser beam in connection with laborers' work; Cast-in- place manhole form setter; Pressure pipelayer; Davis trencher - 300 or similar type (and all small trenchers); Blaster; Diamond driller; Multiple unit drill; Hydraulic drill

GROUP 1: Asphalt spreader boxes (all types); Barko, Wacker and similar type tampers; Buggymobile; Caulker, bander, pipewrapper, conduit layer, plastic pipelayer; Certified hazardous waste worker including Leade Abatement; Compactors of all types; Concrete and magnesite mixer, 1/2 yd. and under; Concrete pan work; Concrete sander; Concrete saw; Cribber and/or shoring; Cut granite curb setter; Dri-pak-it machine; Faller, logloader and bucker; Form raiser, slip forms; Green cutter; Headerboard, Hubsetter, aligner, by any method; High pressure blow pipe (1-1/2"" or over, 100 lbs. pressure/over); Hydro seeder and similar type; Jackhammer operator; Jacking of pipe over 12 inches; Jackson and similar type compactor; Kettle tender, pot and worker applying asphalt, lay-kold, creosote, lime, caustic and similar type materials (applying means applying, dipping or handling of such materials); Lagging, sheeting, whaling, bracing, trenchjacking, lagging hammer; Magnesite, epoxyresin, fiberglass, mastic worker (wet or dry); No joint pipe and stripping of same, including repair of voids; Pavement breaker and spader, including tool grinder; Perma curb; Pipelayer (including grade checking in connection with pipelaying); Precast-manhole setter; Pressure pipe tester; Post hole digger, air, gas and electric; Power broom sweeper; Power tampers of all types (except as shown in Group 2); Ram set gun and stud gun; Riprap stonepaver and rock-slinger, including placing of sacked concrete and/or sand (wet or dry) and gabions and similar type; Rotary scarifier or multiple head concrete chipping scarifier; Roto and Ditch Witch; Rototiller; Sandblaster, pot, gun, nozzle operators; Signalling and rigging; Tank cleaner; Tree climber; Turbo blaster; Vibrascreed, bull float in connection with laborers' work; Vibrator; Hazardous waste worker (lead removal); Asbestos and mold removal worker

GROUP 1-a: Joy drill model TWM-2A; Gardner-Denver model DH143 and similar type drills; Track driller; Jack leg driller; Wagon driller; Mechanical drillers, all types regardless of type or method of power; Mechanical pipe layers, all types regardless of type or method of power; Blaster and powder; All work of loading, placing and blasting of all powder and explosives of whatever type regardless of method used for such loading and placing; High scalers (including drilling of same); Tree topper; Bit grinder

GROUP 1-b: Sewer cleaners shall receive $4.00 per day above Group 1 wage rates. ""Sewer cleaner"" means any worker who handles or comes in contact with raw sewage in small diameter sewers. Those who work inside recently active, large diameter sewers, and all recently active sewer

manholes shal receive $5.00 per day above Group 1 wage rates.

GROUP 1-c: Burning and welding in connection with laborers' work; Synthetic thermoplastics and similar type welding

GROUP 1-d: Maintenance and repair track and road beds. All employees performing work covered herein shall receive $ .25 per hour above their regular rate for all work performed on underground structures not specifically covered herein. This paragraph shall not be construed to apply to work below ground level in open cut. It shall apply to cut and cover work of subway construction after the temporary cover has been placed.

GROUP 1-e: Work on and/or in bell hole footings and shafts thereof, and work on and in deep footings. (A deep footing is a hole 15 feet or more in depth.) In the event the depth of the footing is unknown at the commencement of excavation, and the final depth exceeds 15 feet, the deep footing wage rate would apply to all employees for each and every day worked on or in the excavation of the footing from the date of inception.

GROUP 1-f: Wire winding machine in connection with guniting or shot crete

GROUP 2: Asphalt shoveler; Cement dumper and handling dry cement or gypsum; Choke-setter and rigger (clearing work); Concrete bucket dumper and chute; Concrete chipping and grinding; Concrete laborer (wet or dry); Driller tender, chuck tender, nipper; Guinea chaser (stake), grout crew; High pressure nozzle, adductor; Hydraulic monitor (over 100 lbs. pressure); Loading and unloading, carrying and hauling of all rods and materials for use in reinforcing concrete construction; Pittsburgh chipper and similar type brush shredders; Sloper; Single foot, hand-held, pneumatic tamper; All pneumatic, air, gas and electric tools not listed in Groups 1 through 1-f; Jacking of pipe - under 12 inches

GROUP 3: Construction laborers, including bridge and general laborer; Dump, load spotter; Flag person; Fire watcher; Fence erector; Guardrail erector; Gardener, horticultural and landscape laborer; Jetting; Limber, brush loader and piler; Pavement marker (button setter); Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Tool room attendant (jobsite only)

GROUP 4: Final clean-up work of debris, grounds and building including but not limited to: street cleaner; cleaning and washing windows; brick cleaner (jobsite only); material cleaner (jobsite only). The classification ""material cleaner"" is to be utilized under the following conditions:
A: at demolition site for the salvage of the material.
B: at the conclusion of a job where the material is to be salvaged and stocked to be reused on another job.
C: for the cleaning of salvage material at the jobsite or

temporary jobsite yard.

The material cleaner classification should not be used in the performance of ""form stripping, cleaning and oiling and moving to the next point of erection"".

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural Nozzleman

GROUP 2: Nozzleman, Gunman, Potman, Groundman

GROUP 3: Reboundman

GROUP 4: Gunite laborer

WRECKING WORK LABORER CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash, windows and materials)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

LABO1130-008 07/01/2023

CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS & TUOLUMNE

	Rates	Fringes
Plasterer tender	$ 39.77	28.54

Work on a swing stage scaffold: $1.00 per hour additional.

LABO1130-009 07/01/2023

MARIPOSA, MERCED, STANISLAUS, AND TUOLUMNE COUNTIES

	Rates	Fringes
LABORER (Plaster Tender)	$ 39.77	28.54

Work on a swing stage scaffold: $1.00 per hour additional.

PAIN0016-001 01/01/2024

ALAMEDA, CONTRA COSTA, MONTEREY, SAN BENITO, SAN MATEO, SANTA CLARA, AND SANTA CRUZ COUNTIES

	Rates	Fringes

Painters:.....$ 50.51 27.66

PREMIUMS:

EXOTIC MATERIALS - $1.25 additional per hour.
SPRAY WORK: - $0.50 additional per hour.
INDUSTRIAL PAINTING - $0.25 additional per hour
[Work on industrial buildings used for the manufacture and processing of goods for sale or service; steel construction (bridges), stacks, towers, tanks, and similar structures]

HIGH WORK:
over 50 feet - $2.00 per hour additional
100 to 180 feet - $4.00 per hour additional
Over 180 feet - $6.00 per houir additional

PAIN0016-003 01/01/2024

AREA 1: ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO & SANTA CLARA COUNTIES

AREA 2: CALAVERAS, MARIPOA, MERCED, MONTEREY, SAN BENITO, SAN JOAQUIN, SANTA CRUZ, STANISLAUS & TUOLUMNE COUNTIES

	Rates	Fringes
Drywall Finisher/Taper		
AREA 1	$ 60.41	31.34
AREA 2	$ 56.28	29.94

PAIN0016-012 01/01/2024

ALAMEDA, CONTRA COSTA, MARIPOSA, MERCED, MONTEREY, SAN BENITO, SAN FRANCISCO, SAN MATEO, SANTA CLARA AND SANTA CRUZ COUNTIES

	Rates	Fringes
SOFT FLOOR LAYER	$ 59.00	33.03

PAIN0016-015 01/01/2024

CALAVERAS, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS & TUOLUMNE COUNTIES

	Rates	Fringes
PAINTER		
Brush	$ 40.85	22.40

FOOTNOTES:
SPRAY/SANDBLAST: $0.50 additional per hour.
EXOTIC MATERIALS: $1.25 additional per hour.
HIGH TIME: Over 50 ft above ground or water level $2.00 additional per hour. 100 to 180 ft above ground or water level $4.00 additional per hour. Over 180 ft above ground

or water level $6.00 additional per hour.

PAIN0016-022 01/01/2024

SAN FRANCISCO COUNTY

	Rates	Fringes
PAINTER	$ 54.13	27.66

PAIN0169-001 01/01/2023

FRESNO, KINGS, MADERA, MARIPOSA AND MERCED COUNTIES:

	Rates	Fringes
GLAZIER	$ 44.33	28.88

PAIN0169-005 01/01/2024

ALAMEDA CONTRA COSTA, MONTEREY, SAN BENITO, SAN FRANCISCO, SAN MATEO, SANTA CLARA & SANTA CRUZ COUNTIES

	Rates	Fringes
GLAZIER	$ 56.22	34.00

PAIN0294-004 07/01/2023

FRESNO, KINGS AND MADERA COUNTIES

	Rates	Fringes
PAINTER		
Brush, Roller	$ 34.49	21.80
Drywall Finisher/Taper	$ 35.74	21.80

FOOTNOTE:
Spray Painters & Paperhangers recive $1.00 additional per hour. Painters doing Drywall Patching receive $1.25 additional per hour. Lead Abaters & Sandblasters receive $1.50 additional per hour. High Time - over 30 feet (does not include work from a lift) $0.75 per hour additional.

PAIN0294-005 01/01/2023

FRESNO, KINGS & MADERA

	Rates	Fringes
SOFT FLOOR LAYER	$ 38.53	23.19

PAIN0767-001 01/01/2024

CALAVERAS, SAN JOAQUIN, STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes
GLAZIER	$ 43.25	35.62

PAID HOLIDAYS: New Year's Day, Martin Luther King, Jr. Day, President's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, and Christmas Day.

Employee required to wear a body harness shall receive $1.50 per hour above the basic hourly rate at any elevation.

PAIN1176-001 07/01/2022

HIGHWAY IMPR0VEMENT

	Rates	Fringes
Parking Lot Striping/Highway Marking:		
GROUP 1	$ 40.83	17.62
GROUP 2	$ 34.71	17.62
GROUP 3	$ 35.11	17.62

CLASSIFICATIONS

GROUP 1: Striper: Layout and application of painted traffic stripes and marking; hot thermo plastic; tape, traffic stripes and markings

GROUP 2: Gamecourt & Playground Installer

GROUP 3: Protective Coating, Pavement Sealing

PAIN1237-003 01/01/2024

CALAVERAS; SAN JOAQUIN COUNTIES; STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes
SOFT FLOOR LAYER	$ 48.54	26.59

PLAS0066-002 07/01/2019

ALAMEDA, CONTRA COSTA, SAN MATEO AND SAN FRANCISCO COUNTIES:

	Rates	Fringes
PLASTERER	$ 42.41	30.73

PLAS0300-001 07/01/2018

	Rates	Fringes
PLASTERER		
AREA 188: Fresno	$ 32.70	31.68

AREA 224: San Benito, Santa Clara, Santa Cruz.....	$ 32.88	31.68
AREA 295: Calaveras & San Joaquin Couonties.....	$ 32.70	31.68
AREA 337: Monterey County..	$ 32.88	31.68
AREA 429: Mariposa, Merced, Stanislaus, Tuolumne Counties.....	$ 32.70	31.68

PLAS0300-005 07/01/2016

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	$ 32.15	23.27

PLUM0038-001 07/01/2023

SAN FRANCISCO COUNTY

	Rates	Fringes
PLUMBER (Plumber, Steamfitter, Refrigeration Fitter).....	$ 85.50	48.98

PLUM0038-005 07/01/2023

SAN FRANCISCO COUNTY

	Rates	Fringes
Landscape/Irrigation Fitter (Underground/Utility Fitter).....	$ 72.68	32.91

PLUM0062-001 07/01/2024

MONTEREY AND SANTA CRUZ COUNTIES

	Rates	Fringes
PLUMBER & STEAMFITTER.....	$ 53.00	41.70

PLUM0159-001 07/01/2024

CONTRA COSTA COUNTY

	Rates	Fringes
Plumber and steamfitter		
(1) Refrigeration.....	$ 65.28	48.04
(2) All other work.....	$ 66.17	48.04

PLUM0246-001 07/01/2024

FRESNO, KINGS & MADERA COUNTIES

	Rates	Fringes
PLUMBER & STEAMFITTER.....	$ 50.00	40.69

PLUM0246-004 01/01/2017

FRESNO, MERCED & SAN JOAQUIN COUNIES

	Rates	Fringes
PLUMBER (PIPE TRADESMAN).....	$ 13.00 **	10.74

PIPE TRADESMAN SCOPE OF WORK:
Installation of corrugated metal piping for drainage, as well as installation of corrugated metal piping for culverts in connection with storm sewers and drains; Grouting, dry packing and diapering of joints, holes or chases including paving over joints, in piping; Temporary piping for dirt work for building site preparation; Operating jack hammers, pavement breakers, chipping guns, concrete saws and spades to cut holes, chases and channels for piping systems; Digging, grading, backfilling and ground preparation for all types of pipe to all points of the jobsite; Ground preparation including ground leveling, layout and planting of shrubbery, trees and ground cover, including watering, mowing, edging, pruning and fertilizing, the breaking of concrete, digging, backfilling and tamping for the preparation and completion of all work in connection with lawn sprinkler and landscaping; Loading, unloading and distributing materials at jobsite; Putting away materials in storage bins in jobsite secure storage area; Demolition of piping and fixtures for remodeling and additions; Setting up and tearing down work benches, ladders and job shacks; Clean-up and sweeping of jobsite; Pipe wrapping and waterproofing where tar or similar material is applied for protection of buried piping; Flagman

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PLUM0342-001 07/01/2023

ALAMEDA & CONTRA COSTA COUNTIES

	Rates	Fringes
PIPEFITTER		
CONTRA COSTA COUNTY.....	$ 74.00	47.45
PLUMBER, PIPEFITTER, STEAMFITTER		
ALAMEDA COUNTY.....	$ 74.00	47.45

PLUM0355-004 07/01/2024

ALAMEDA, CALAVERAS, CONTRA COSTA, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, MONTEREY, SAN BENITO, SAN JOAQUIN, SAN MATEO, SANTA CLARA, SANTA CRUZ, STANISLAUS, AND TUOLUMNE COUNTIES:

	Rates	Fringes
Underground Utility Worker		
/Landscape Fitter.....	$ 34.51	18.30

PLUM0393-001 07/01/2021

SAN BENITO AND SANTA CLARA COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER	$ 68.76	46.63

PLUM0442-001 07/01/2024

CALAVERAS, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS & TUOLUMNE COUNTIES

	Rates	Fringes
PLUMBER & STEAMFITTER	$ 54.05	36.99

PLUM0467-001 07/01/2024

SAN MATEO COUNTY

	Rates	Fringes
Plumber/Pipefitter/Steamfitter...	$ 83.75	40.65

ROOF0027-002 01/01/2024

FRESNO, KINGS, AND MADERA COUNTIES

	Rates	Fringes
ROOFER	$ 42.51	16.11

FOOTNOTE: Work with pitch, pitch base of pitch impregnated products or any material containing coal tar pitch, on any building old or new, where both asphalt and pitchers are used in the application of a built-up roof or tear off: $2.00 per hour additional.

ROOF0040-002 08/01/2024

SAN FRANCISCO & SAN MATEO COUNTIES:

	Rates	Fringes
ROOFER	$ 55.30	22.97

ROOF0081-001 08/01/2023

ALAMEDA AND CONTRA COSTA COUNTIES:

	Rates	Fringes
Roofer	$ 52.47	22.31

ROOF0081-004 08/01/2024

CALAVERAS, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes
ROOFER	$ 49.65	22.19

ROOF0095-002 08/01/2023

MONTEREY, SAN BENITO, SANTA CLARA, AND SANTA CRUZ COUNTIES:

	Rates	Fringes
ROOFER		
Bitumastic, Enameler, Coal Tar, Pitch and Mastic worker	$ 57.17	21.51
Journeyman	$ 53.17	21.51
Kettle person (2 kettles)	$ 55.17	21.51

SFCA0483-001 08/01/2024

ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO AND SANTA CLARA COUNTIES:

	Rates	Fringes
SPRINKLER FITTER (FIRE)	$ 79.13	38.51

SFCA0669-011 01/01/2024

CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, MONTEREY, SAN BENITO, SAN JOAQUIN, SANTA CRUZ, STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes
SPRINKLER FITTER	$ 44.32	27.83

SHEE0104-001 07/01/2020

AREA 1: ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO, SANTA CLARA

AREA 2: MONTEREY & SAN BENITO

AREA 3: SANTA CRUZ

	Rates	Fringes
SHEET METAL WORKER		
AREA 1:		
Mechanical Contracts under $200,000	$ 55.92	45.29
All Other Work	$ 64.06	46.83

AREA 2	$ 52.90	36.44
AREA 3	$ 55.16	34.18

SHEE0104-003 07/01/2021

CALAVERAS AND SAN JOAQUIN COUNTIES:

	Rates	Fringes
SHEET METAL WORKER	$ 44.34	39.22

SHEE0104-005 07/01/2021

MARIPOSA, MERCED, STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes
SHEET METAL WORKER (Excluding metal deck and siding)	$ 41.28	45.41

SHEE0104-007 07/01/2021

FRESNO, KINGS, AND MADERA COUNTIES:

	Rates	Fringes
SHEET METAL WORKER	$ 44.07	40.79

SHEE0104-015 07/01/2020

ALAMEDA, CONTRA COSTA, MONTEREY, SAN BENITO, SAN FRANCISCO, SAN MATEO, SANTA CLARA AND SANTA CRUZ COUNTIES:

	Rates	Fringes
SHEET METAL WORKER (Metal Decking and Siding only)	$ 44.45	35.55

SHEE0104-018 07/01/2020

CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes
Sheet metal worker (Metal decking and siding only)	$ 44.45	35.55

TEAM0094-001 07/01/2024

	Rates	Fringes
Truck drivers:		
GROUP 1	$ 41.54	33.25
GROUP 2	$ 41.84	33.25
GROUP 3	$ 42.14	33.25
GROUP 4	$ 42.49	33.25

GROUP 5.....$ 42.84 33.25

FOOTNOTES:
Articulated dump truck; Bulk cement spreader (with or without auger); Dumpcrete truck; Skid truck (debris box); Dry pre-batch concrete mix trucks; Dumpster or similar type; Slurry truck: Use dump truck yardage rate.
Heater planer; Asphalt burner; Scarifier burner; Industrial lift truck (mechanical tailgate); Utility and clean-up truck: Use appropriate rate for the power unit or the equipment utilized.

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Dump trucks, under 6 yds.; Single unit flat rack (2-axle unit); Nipper truck (when flat rack truck is used appropriate flat rack shall apply); Concrete pump truck (when flat rack truck is used appropriate flat rack shall apply); Concrete pump machine; Fork lift and lift jitneys; Fuel and/or grease truck driver or fuel person; Snow buggy; Steam cleaning; Bus or personhaul driver; Escort or pilot car driver; Pickup truck; Teamster oiler/greaser and/or serviceperson; Hook tender (including loading and unloading); Team driver; Tool room attendant (refineries)

GROUP 2: Dump trucks, 6 yds. and under 8 yds.; Transit mixers, through 10 yds.; Water trucks, under 7,000 gals.; Jetting trucks, under 7,000 gals.; Single-unit flat rack (3-axle unit); Highbed heavy duty transport; Scissor truck; Rubber-tired muck car (not self-loaded); Rubber-tired truck jumbo; Winch truck and ""A"" frame drivers; Combination winch truck with hoist; Road oil truck or bootperson; Buggymobile; Ross, Hyster and similar straddle carriers; Small rubber-tired tractor

GROUP 3: Dump trucks, 8 yds. and including 24 yds.; Transit mixers, over 10 yds.; Water trucks, 7,000 gals. and over; Jetting trucks, 7,000 gals. and over; Vacuum trucks under 7500 gals. Trucks towing tilt bed or flat bed pull trailers; Lowbed heavy duty transport; Heavy duty transport tiller person; Self- propelled street sweeper with self-contained refuse bin; Boom truck - hydro-lift or Swedish type extension or retracting crane; P.B. or similar type self-loading truck; Tire repairperson; Combination bootperson and road oiler; Dry distribution truck (A bootperson when employed on such equipment, shall receive the rate specified for the classification of road oil trucks or bootperson); Ammonia nitrate distributor, driver and mixer; Snow Go and/or plow

GROUP 4: Dump trucks, over 25 yds. and under 65 yds.; Water pulls - DW 10's, 20's, 21's and other similar equipment when pulling Aqua/pak or water tank trailers; Helicopter pilots (when transporting men and materials); Lowbedk Heavy Duty Transport up to including 7 axles; DW10's, 20's, 21's and other similar Cat type, Terra Cobra, LeTourneau Pulls, Tournorocker, Euclid and similar type equipment when pulling fuel and/or grease tank trailers or other

miscellaneous trailers; Vacuum Trucks 7500 gals and over and truck repairman

GROUP 5: Dump trucks, 65 yds. and over; Holland hauler; Low bed Heavy Duty Transport over 7 axles

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($17.75) or 13658 ($13.30). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor

200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"

SECTION 00 22 13.03 – SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Supplementary Instructions to Bidders consisting of procedures and conditions for the use of documents of various types and formats for bidding of this project.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 DEFINITIONS

A. Hard Copy Format: Documents printed on paper medium.

B. Electronic Image Format: Electronic Files consisting of Bid Documents in an image format such as PDF's, TIFF's and etc. These files are to be READ ONLY.

1.3 SUBMITTALS

A. Submit in accordance with the following:
   1. Bidder's Usage Agreement for Bid Documents:
      a. Hard Copy and Electronic Image Format Form.

PART 2 - PRODUCTS
(NOT APPLICABLE)

PART 3 - EXECUTION

3.1 SCHEDULES:

A. BIDDER'S USAGE AGREEMENT FOR BID DOCUMENTS:
   1. HARD COPY AND ELECTRONIC IMAGE FORMAT: When the Bid Documents are being issued electronically, the HARD COPY AND ELECTRONIC IMAGE FORMAT FORM shall be used.
      a. This form shall be submitted and signed as a condition of receiving Bid Documents.

3.2 BIDDER'S USAGE AGREEMENT FOR BID DOCUMENTS HARD COPY AND ELECTRONIC IMAGE FORMAT

Project Name: _____
DA Project No.: _____
I, _____, as duly authorized agent of _____ ("Bidder") as prospective bidder on the above named project ("Project") is requesting a copy of the project BID DOCUMENTS (bidding requirements, contract requirements, specifications, contract drawings, resource drawings if any, and addenda to date).

A. Bidder is being provided copies of Bid Documents for the Project, which consists of two parts. One part of the Bid Documents is in the Hard Copy Format ("HCF") and the other part is in the Electronic Image Format ("EIF") on CD-ROM. Bidder acknowledges that HCF Documents and the EIF Documents are being provided as the official record set of documents issued for bidding. It is the Bidder's responsibility to review and obtain all information from both the HCF and the EIF documents necessary for a complete and accurate bid. This request is subject to the following conditions, which the Bidder hereby agrees to abide by:

B. Bidder shall pay a non-refundable deposit for the Bid Documents in the amount of (See Instructions to Bidders) per set. In the event the Bidder is not the successful bidder, the bidder agrees to permanently dispose of the HCF and EIF on the Project CD-ROM.

C. Bidder acknowledges that neither the EIF documents nor the CD-ROM will be updated by the Design Team. The CD-ROM contains the original documents and will not be updated regardless of when Bidder obtains the CD-ROM. Any changes to the contract documents will be issued as a separate document.

D. Bidder is further warned that while the EIF information appears to be extremely accurate, this apparent accuracy is an artifact of the techniques used to generate it and is no way intended to imply actual accuracy. The Bidder acknowledges and takes full responsibility for the accuracy, correctness of measurements, areas, inventories derived, conclusions drawn, and information extracted from the EIF documents.

E. Bidder understands and agrees the HCF and EIF documents are instruments of Architect's and Architect's Consultants' ("Design Team") professional service and are intended for one-time use by Bidder in the bidding of the Project. All HCF and EIF documents are and shall remain the property of the Design Team, who is deemed to be the author of the drawings and data, and the Design Team shall retain all common law, statutory law, and all other rights, including copyrights, with respect to Bidder.

F. The Bidder shall indemnify and hold harmless, the Design Team, its officers, directors, employees or subcontractors, to the fullest extent permitted by law, against all claims, liabilities, losses, damages, and costs, including but not limited to attorney's fees and defense costs arising out of or resulting from Bidder or any other person or entity that gains information from the Bid Documents or copies any part of the Bid Documents, or uses the Bid Documents or copies any part of the Bid Documents, for purposes other than the bidding of this project, and will be liable to the Design Team for fees equal to the fees paid by the client pursuant to developing the documents for this project.

DARDEN ARCHITECTS, INC.

Description of the HCF Documents and the EIF Documents on CD-ROM, provided:
_____
_____
_____

_____ _____
Print Name (Bidder) Title

_____ _____
Signature Date:

END OF SECTION

SECTION 01 11 13 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Construction of the work for **Ag Technology (TEC) Innovation Center, MERCED**, California. The work is defined as all material, labor, equipment and services necessary to do all work shown on the drawings and called for in the Specifications. The Work shall be as indicated on the Contract Documents.

B. This Section includes the following:
   1. Summarizes the Work of the Contract.
   2. Establishes requirements governing the Work.
   3. Identifies the Work that will be performed under separate contracts and the coordination.
   4. Project Site access.
   5. Restrictions under which the project will be constructed.

C. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

D. List below only sections for this Project that the reader might expect to find related work but are specified elsewhere. Verify that the Section titles listed below for this Project's Specifications are correct.
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 DEFINITIONS

A. The words "OWNER" and "DISTRICT" are synonymous and interchangeable, when used throughout this Project Manual.

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES.
   1. Quality Assurance/Control Submittals:
      a. Certificates:
         1) Submit three (3) copies of certificates indicating compliance with the Asbestos Hazard Emergency Regulations Act.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Contractor's Qualifications:
      a. Contractor shall have experience and have successfully completed three (3) projects of similar scope and size to that indicated for this project.
      b. Contractor shall have demonstrated that they have the resources to perform all of the requirements of this project.

B. Regulatory Requirements:

1. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on performance of Work, and in accordance with Specification Section - REGULATORY REQUIREMENTS:
    a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA), in the area where the Project is located.

C. Certifications:
1. The Contractor shall certify in writing that no materials containing Asbestos are incorporated in the work, in accordance with the Asbestos Hazard Emergency Regulations Act.

D. Contractor's Duties:
1. Except as specifically noted, provide and pay for:
    a. Labor, material and equipment.
    b. Tools, construction equipment and machinery.
    c. Heat and utilities required for construction. See Specification Section - TEMPORARY FACILITIES AND CONTROLS.
    d. Other facilities and services necessary for proper execution and completion of Work.
2. Pay legally required sales, consumer and use taxes.
3. Secure and pay for all site specific as necessary for proper execution and completion of Work.
    a. Licenses.
    b. Permits and Fees.
    c. Government Fees.
    d. Royalties.
4. Give required notices.
5. Promptly submit written notice to Architect of observed variance.
6. Enforce strict discipline and good order among employees. Do not employ on Work:
    a. Unfit persons.
    b. Persons not skilled in assigned task.

1.5 WORK UNDER OTHER CONTRACTS

A. General Requirements:
1. Work under separate contracts will occur throughout the duration of the project. The work being installed under separate contracts will occur around adjacent to the Contract project site.
2. Contractor shall coordinate its work with the work under separate Contracts and shall cooperate with the Contractors of these separate Contracts as they occur.
3. Should the Contractor damage and/or otherwise alter work installed under separate contracts, the Contractor is responsible for the repair and/or correction of installed work.
4. Prior to the installation of the Work, coordinate the work installed or to be installed by separate contracts relative to this project scope of work.

B. Work by Owner:
1. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this contract or work by Owner. Coordinate the work of this Contract with work performed by Owner.
2. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be constructed simultaneously with work under this Contract.

a. Items that are Owner Furnished Contractor Installed and Owner Furnished Owner Installed as indicated on the Contract Drawings and as defined in Specification Section - OWNER FURNISHED ITEMS.

3. Security and Intrusion Alarm System: Owner's Vendor will design the Intrusion Alarm System and identify pathways that need to be provided under the Contractor's Construction Contract.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

A. Access to Site:

1. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of the Project.
2. Contractor shall be responsible for coordinating access to and from the site throughout the duration of the project. Access to and from the site may vary, based upon timing and duration of separate contracts.
3. The Contractor shall not use the Off-Site areas, with the exception of the Site Access per Specification Section - TEMPORARY FACILITIES AND CONTROLS, and shall not interfere with the work in these areas.

B. Contractor Use of Premises:

1. Confine operations at sites to areas permitted by:
   a. Laws.
   b. Ordinances.
   c. Permits.
   d. Contract Documents.
2. Do not unreasonably encumber site with materials or equipment.
3. Assume full responsibility for protection and safekeeping of Contractor's and Owner's material stored on premises, and keep the site and building secure at all times.
4. Obtain and pay for use of additional storage Work areas needed for operations.
5. Limit use of Site Work and storage.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION

SECTION 01 21 13 – ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all allowance materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
   2. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by CHANGE ORDER.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

C. Allowances (Types):
   1. Lump-sum allowances.
   2. Percentage of Bid Item(s) amount.

1.2 DEFINITIONS

A. Lump-Sum Allowances:
   1. Allowance shall include cost to Contractor of specific products and materials ordered under allowance and shall include taxes, freight, and delivery to Project site.
   2. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.3 SYSTEM DESCRIPTION

A. Selection and Purchase:
   1. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
   2. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
   3. Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Although not considered a CHANGE ORDER, submit proposals for purchase of products or systems included in allowances, in the form specified for a CHANGE ORDER.
   2. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
   3. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

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1.5 QUALITY ASSURANCE

A. Meetings:

1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
   a. Coordinate the work with other work being performed.
   b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
   a. Review for proper installation of work progress.
   b. Identify any installation problems and acceptable corrective measures.
   c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
   a. Inspect and identify any problems, which may impede issuance of warranties or guaranties.
   b. Maintaining installed work until the Notice of Substantial Completion has been filed.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 MAINTENANCE

1. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
   a. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

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3.3 SCHEDULES

A. Allowance No. 1 - $5,000.00:
   1. Includes: Replacement of existing or the installation of new sprinkler heads, valves, piping and other equipment and accessories necessary for the proper operation of the existing system where not specifically shown on the drawings for replacement or new installation.as indicated in the Irrigation Drawings.

B. Allowance No. 2 - $3,000.00
   1. Includes: The removal and replacement of existing plants/turfgrass and/or the installation of new plants/turfgrass where not specifically shown on the drawings for replacement or installation.

C. Allowance No. 3 - 2% of the bid for structural steel, misc. Iron and reinforcing steel.
   1. Includes: Refer to General Notes on Structural Drawing X/S101.

END OF SECTION

SECTION 01 25 00 – SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Work that is substituted for Work specified in DIVISIONS 02 through 49 shall meet the requirements of this Section.
   2. Provide all material, labor, equipment and services necessary to completely install all approved substituted materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
   3. See the INSTRUCTIONS TO BIDDERS or the GENERAL CONDITIONS for any time limits set for the submittal of substitutions.
   4. Substitutions can be requested in two ways: a. "Prior to Bid Opening", and b. "After Award of the Contract":
      a. "Prior to Bid Opening": The Contractor or Bidder must insure that proposed substitutions of materials by the Contractor or Bidder are submitted to the Architect's office no later than fourteen (14) calendar days prior to the Bid Opening for review and possible approval of any equipment or materials thought to be equal to or better than those specified in the drawings or specifications. An Addendum will be issued no later than three (3) calendar days prior to Bid Opening including all equipment and materials deemed equivalent to those specified and approved by the Architect.
      b. "After Award of the Contract": In accordance with the provisions of Section 3400 of the California Public Contract Code, the Contractor awarded the Contract will be provided a period of thirty-five (35) calendar days after the award of the Contract for submission of data substantiating a request for a substitution of "an equal" item or items.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 DEFINITIONS

A. Claimant: Bidder, Sub-Contractor, Contractor, Distributor, Supplier, Manufacturer or other entity that is submitting a claim for a substitution.

B. Substitutions: Substitutions are not a part of the Submittal Process described in Specification Section – SUBMITTAL PROCEDURES. Substitution Requests by a claimant must be reviewed and approved by the Architect before any submittal will be accepted. It is the claimant's responsibility to provide clear and concise documentation to expedite the Architect’s review. If the Substitution Request requires re-submission(s) due to the Claimant's inadequate documentation, no time extension will be allowed.
   1. Changes to the structural, accessibility, or life-safety portions of the DSA-approved Contract Documents shall be submitted to and approved by DSA as a Construction Change Document, prior to the fabrication and installation as required by California Administrative Code, Title 24, Part 1, Section 4-338, and DSA IR A-6.

C. "Or Equal" / "Or Approved Equivalent": Claimant shall request a substitution in accordance with this Specification Section – SUBSTITUTION PROCEDURES.

D. The Project Manual employs the following methods of specifying products. Claimant shall conform to the directives below for this Project:
   1. Product, system or design specified only by reference standards:
      a. Select any product, system or design meeting reference standards.
   2. Product, system or design specified by naming several products, systems, designs and/or manufacturers:
      a. Select any product, system, design and/or manufacturer named.
   3. Product, system or design specified by naming several products, systems and/or manufacturers and reference standards:
      a. Products, systems, designs and/or manufacturer names indicate products, systems, designs and/or manufacturers that (in the Architect's opinion) meets the reference standards.
      b. Select any of the named manufacturer's products, systems or designs meeting the reference standards.
   4. Product, system or design specified by naming one or more products, systems, designs and stating "or equal to," "or approved equivalent," with the specified products, systems or designs:
      a. Select product, system or design specified, "or approved equivalent."
   5. Product, system or design specified by naming only one product, system or design:
      a. Select product, system or design specified, "or approved equivalent."
   6. Product, system or design specified by naming only one product, system or design and followed by the statement "DISTRICT STANDARD – NO SUBSTITUTIONS":
      a. Provide product, system or design specified. No substitutions allowed.

E. Cost to Claimant for review of Substitution Request:
   1. Each review of a Substitution Request by the Architect and/or it's Consultant(s) will be billed to the Claimant at an hourly rate of **$212.00** an hour, two hour minimum for each review, whether approved or rejected.
      a. Waiver of review fees:
         1) When the product has been discontinued or is unavailable.
            a) EXCEPTION: Where the claimant has failed to order in a timely manner and waits until the last minute, no consideration of the waiver of fees will be allowed; no time extensions will be allowed.
         2) When the Owner has requested a substitution.

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - INSTRUCTIONS TO BIDDERS:

B. Content of Request:
   1. Check made payable to DARDEN ARCHITECTS, INC. for the minimum two hour review period for **$424.00**, non-refundable.
      a. When additional time is required to review a substitution request beyond the first two hours, the Architect or its consultants will bill the claimant for the time expended in the review process.
   2. Complete the attached **SUBSTITUTION REQUEST FORM** substantiating compliance of proposed substitution with Contract Documents. **NO OTHER FORMS WILL BE ACCEPTED.**
   3. Attach to the SUBSTITUTION REQUEST FORM an itemized comparison of proposed substitution with product, system or design specified.
   4. For products or systems, attach to the SUBSTITUTION REQUEST FORM:
      a. Product, system or design identification, including manufacturer's name and address.
   5. Manufacturer's product information: MUST BE HIGHLIGHTED AND PROJECT SPECIFIC. SUBMITTALS NOT ADEQUATELY MARKED-UP ACCORDING TO PROJECT SPECIFICS WILL BE REJECTED:

a. Literature including product, system or design description, performance and test data and reference standards.
b. Samples.
c. Warranties.

6. For construction methods, attach to the SUBSTITUTION REQUEST FORM:
a. Detailed description of proposed methods.
b. Drawings illustrating methods.

C. Submit three (3) copies of Substitution Request including all attached data.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Product, system or design qualifications:
a. In making a request for substitution, Claimant certifies that:
1) Claimant has personally investigated proposed product, system or design, and determined that it is equal or superior in all respects to that specified.
2) Claimant shall provide the same guarantee or warranty for substitution as for product, system or design specified.
3) Claimant shall coordinate installation of accepted substitution into the Project, making such changes as may be required for the Project to be complete in all respects.
4) Claimant waives all claims for additional costs related to substitution which subsequently become apparent for integrating the substituted product, system or design into the Project.
5) Claimant waives all claims for time extension(s) due to improper documentation requiring re-submission(s) of a Substitution Request Review.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
a. Products (and installation standards), systems or methods used for this Project shall comply with CARB standards in effect at the Project Site, and at the time of installation.

C. Acceptance of Substitutions:
1. Procedures:
a. The Contract is based on products, systems or designs described in the Contract Documents.
b. Architect will consider proposals submitted in accordance with time limits set within the Specification Section - INSTRUCTIONS TO BIDDERS.
c. Architect is solely responsible for judging the acceptance of substitutions.
1) Acceptance of a substitution does not waive the product manufacturer's responsibility for product liability. The Architect will judge (based on the substitution submission data) for function and use – product liability shall remain the responsibility of the product manufacturer.
d. Substitute products, systems or designs shall not be used unless the substitutions have been specifically approved for this Project by the Architect.
1) Substitute products, systems or designs that are related to structural, fire and life safety or access compliance shall not be used unless such substitution have been specifically approved for this Project by the Architect and the appropriate authority having jurisdiction.
2. Substitutions will not be considered if:

a. They are indicated or implied on product submittals in accordance with Specification Section - SUBMITTAL PROCEDURES. Substitutions are not Submittals, and must be reviewed and approved prior to being submitted as a Submittal.
b. Acceptance will require substantial revision of Contract Documents.
c. They are submitted after the date set for substitutions within this Contract, unless:
    1) The specified or drawing item that has been verified to be discontinued or is otherwise unavailable.
    2) The Owner proposes a cost savings for the product, system or method.
    3) The Owner proposes early occupancy, and the proposed substitution allows for that convenience.

3. Substitutions affecting DSA-regulated items shall be considered as construction documents (CCD's) and shall be approved prior to fabrication and installation per DSA IR A-6 and Section 338(c) Part 1, Title 24 CCR.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 SCHEDULES

A. Substitution Request Form:
    1. See the form attached to the end of this section.
    2. The attached form will be reproduced (and sequentially numbered by the Contractor after the award of the Contract) by the Claimant for any and all proposed substitutions.
    3. **NO OTHER FORMS WILL BE ACCEPTED.**

(Attachment)

SUBSTITUTION REQUEST FORM

TO: DARDEN ARCHITECTS, INC.
6790 N. West Avenue
Fresno, CA 93711

_____ Check attached for minimum review $424.00.

CHECK APPROPRIATE LINE:

_____ Substitution Request Prior to Bid (During Bid Period)
_____ Product or System Substitution
_____ Design Change Substitution

_____ Substitution Request After Award of the Contract
_____ Product or System Substitution
_____ Design Change Substitution

The Contractor Awarded the Contract for this Project shall assign sequential Substitution Request # below.
Leave blank if submitted during the Bid Period.

SUBSTITUTION REQUEST #_____

WE HEREBY SUBMIT FOR YOUR CONSIDERATION THE FOLLOWING PRODUCT OR METHOD AS SUBSTITUTION FOR THE SPECIFIED OR DRAWING ITEM FOR THIS PROJECT:

PROJECT: _____

SPECIFIED ITEM: _____

_____	_____	_____	_____
Specification Section #	Page #	Paragraph #	Description

OR
DRAWING ITEM: _____

_____	_____	_____
Drawing #	Detail Cut #	Description

PROPOSED CREDIT IF ANY: _____

PROPOSED SUBSTITUTION:
_____
_____
_____
_____

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents to which the proposed substitution will require for its proper installation.

The undersigned claimant certifies: (Modifications by the claimant to the following list is cause for automatic rejection without further review)

1. The proposed substitution does not affect dimensions shown on drawings or code requirements indicated.
2. The undersigned claimant shall compensate the Architect at a rate of **$212.00** an hour, two hour minimum for each review (check for **$424.00** must be attached to this form), for investigation and comments whether or not the request is approved for changes required to the building design, including engineering design, detailing, and construction costs caused by the requested substitution. The Architect is herein defined as any of those firms or individuals listed by reference on the Drawings, including all Consultants identified herein.
3. The proposed substitution will have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.
5. Attach information for a minimum of three projects where the substitution has been used locally within a 200 mile distance of this project, including names, addresses and telephone numbers of Owners who have accepted this product into their projects.
6. Attach all cost data with explanations if different from Specified or Drawing item. Include in that explanation a discussion on quality of proposed substitution and cost differential.
7. The undersigned claimant shall pay for any subsequent changes in incorporating the proposed substitution that were not apparent at the time of approval into the Work, including compensation to the Architect as described in item 2 above.

The undersigned Claimant(s) declares under penalty of perjury per the California Government Code Section 12650, et seq., that the claim of function, appearance and quality are equivalent or superior to the specified or drawing item, and further know and understand that submission for certification of a false claim may lead to fines, imprisonment and/or other severe legal consequences.

SUBMITTED BY CLAIMANT:

Signature_____
Firm_____

Address_____
_____
Date_____
Telephone_____

ADDITIONAL CLAIMANT SIGNATURE REQUIRED:

The Contractor or Construction Manager if submitted after the Award:

Signature_____
Firm_____

DESIGN CONSULTANT USE ONLY:

___ Check Not Attached - Not Accepted
___ Accepted
___ Accepted as Noted
___ Not Accepted
___ Received Past Time Period Allowed by Public Contract Code #3400.

By _____Date _____
Remarks_____
_____
_____
_____
_____

END OF SECTION

SECTION 01 29 73.01 – SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the administrative and procedural requirements necessary to prepare and process the following:
   1. Schedule of Values
      a. Schedule of Bid Values.
      b. Complete Schedule of Values.
   2. Unit Price Schedules.
   3. Application for Payment with Certification.

B. Related Requirements: The following Project Manual Sections contain requirements that relate to this section:

1.	01 11 13	SUMMARY OF WORK.
2.	01 21 13	ALLOWANCES.
3.	01 23 00	ALTERNATES.
4.	01 32 16	CONSTRUCTION SCHEDULE.
5.	01 32 26	FORMS AND REPORTS.
6.	01 33 00	SUBMITTAL PROCEDURES.
7.	01 41 00	REGULATORY REQUIREMENTS.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring and controlling the construction project. Activities included in a Schedule of Values and Payment Request consume cost for time and resources.

B. Activity Code: Identifies each activity so as to be organized, group and sorted into Sub-Schedules, Areas of Work, and Reports.

C. Allowances: Contract amounts allocated for specific activities of the project as identified in the contract documents.

D. Application for Payments: A statement furnished by the Contractor allocating portions of the Contract Sum to various portions of the Work stipulating the amount of work that has been completed to date.

E. Contingency: Contract amounts allocated for non-specific activities, to cover changes in the contract document work, unforeseen conditions and added scope of work to the project.

F. Major Scope: Significant portions of work identified as, but not limited to, Base Bid, Alternate Bids, and Construction Phases, and Funding Criteria.

G. Responsible Party: Entity that is responsible for performing the work of each activity as identified, but not limited to, General Contractor, and Sub-Contractor, second and tertiary tier Sub-Contractors, Manufacturers, Fabricators and Vendors.

H. Schedule of Values: A statement furnished by the Contractor allocating portions of the Contract Sum to various portions of the Work.

I. Scope Type: Segments of work identified as, but not limited to, Building ID, On-Site, and Off-Site.

J. Sub-Schedules: Separated activities identified as part of the same element of work and arranged to show correlation with related elements.

K. Unit Prices: A price per unit of measurement for materials, equipment, or services, or a portion of the Work that are applicable during the duration of the Work.

1.4 SUBMITTALS

A. General:
   1. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES.

B. Format for Submittals: A tabular form type schedules.
   1. Provide a working electronic copy of schedule file.
      a. Provide schedule files on Compact Disc (CD) or Digital Versatile Disc (DVD) (WINDOWS Formatted Disks) in a form that can be reviewed and used by the Owner, and Architect.
   2. Provide PDF electronic copy of schedule file.
   3. Provide [**Two (2)**] paper copies of schedules.
      a. Sheet size shall be of adequate size to clearly show the required information for the entire construction period.
      b. All required documentation shall have the Submittal number posted in the upper-right hand corner of the page.

C. Assurance/Control Submittals:
   1. Schedule of Values.
      a. Schedule of Bid Values.
         1) Submit within **fourteen (14)** days after the Award of Contract.
      b. Complete Schedule of Values.
         1) Submit at the earliest possible date, but no later than **fifteen (15)** days prior to the date scheduled for submittal of initial Application for Payment.
   2. Application for Payment and Certification.
      a. Application for Payment and Certification Forms.
         1) Submit along with the Complete Schedule of Values submittal.
      b. Initial Application for Payment.
         1) Submit **seven (7)** prior to due date.
      c. Application for Payment for Progress of Work.
         1) Submit monthly by the date directed by Owner.
      d. Application for Payment at Substantial Completion.
         1) Submit after Architect issues the Certificate of Substantial Completion.
      e. Final Application for Payment.
         1) Submit after competing Project Closeout requirements.
   3. Schedule of Unit Price.

1.5 SYSTEM DESCRIPTON

A. General:
   1. The Architect considers the project Schedule of Values requirements to be significant to both the Contractor and the Owner. The development, submittal, and acceptance of the Schedule of Values, (Bid and Complete), and subsequent development and maintenance of the Application for Payments must be given high priority.
      a. No payment will be made without the Architect's review and acceptance of the Schedule of Values.
      b. Progress payments may be withheld in whole or part should the Contractor fail to comply with the requirements of this section.
      c. No separate payment will be made to the Contractor for any of the requirements of this section. All such costs shall be part of the Contractor's planned project overhead costs included in its bid.

B. Performance Requirements:

1. Schedule of Bid Values: The Schedule of Bid Values shall be a breakdown of the Bid(s) submitted in the Bid Proposal and shall include all work that was bid on, regardless the scope of work awarded for construction. The breakdown shall be sufficient for the use by the Owner and Owner's Consultants to evaluate and determine cost of major scopes of work and the value of other owner agreements that are associated with the dollar value of the bid proposal.
    a. Refer to Specification Section - SUMMARY OF WORK.
    b. Refer to Specification Section - ALLOWANCES.
    c. Refer to Specification Section - ALTERNATES.
2. Complete Schedule of Values: Breakdown of the Contract Sum by specific line-item values, based on the individual activities in the Baseline Project Construction Schedules and to be the basis for the development of the Application for Payment.
    a. Refer to Specification Section - CONSTRUCTION SCHEDULES.
3. Application for Payments: Shall be derived from Baseline Project Construction Schedule utilizing the costs in the Complete Schedule of Values, and from subsequent Project Construction Schedule Updates, reflecting the Work performed as of planned and actual dates.
    a. Refer to Specification Section - CONSTRUCTION SCHEDULES.
4. Unit Prices: If the Scope of Work or estimated quantities of Work by the Contract Documents is increased or decreased, Unit Prices are added to or deducted from the Contract Sum by appropriate modification.

1.6 QUALITY ASSURANCE

A. Qualifications:
    1. The Contractor must have the capacity and capability of supporting the project by producing schedule-related data within **two (2)** days of request by the Architect, or Owner.
B. Regulatory Requirements:
    1. In accordance with Specification Section - REGULATORY REQUIREMENTS.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Coordination:
    1. Coordinate preparation of the Schedule of Bid Values with the submitted Bid Proposal and reflect the major scope of work breakdown described in Specification Section – SUMMARY OF WORK and Specification Section -- ALTERNATES.
    2. Coordinate preparation of the Complete Schedule of Values with the preparation of the Baseline Project Construction Schedule. Refer to Specification Section -- CONSTRUCTION SCHEDULES.
    3. Correlate line items in the Complete Schedule of Values with other required administrative forms and schedules, including, but not limited to, the following:
        a. Application for Payment forms with continuation sheets.
        b. Submittals Schedule.
        c. Items required to be indicated as separate activities in the Baseline Project Construction Schedule.
B. Project Information:
    1. Identification: Include the following Project Identification on all Schedule of Values and Application for Payment.
        a. Project Name and Location.
        b. Name of Owner and Address.
        c. Name of Architect and Address.

d. Architect's Project Number.
e. Contractor's Name and Address.
f. Submittal Date.

2.2 SCHEDULE OF BID VALUES

A. Format:
1. Arrange the Schedule of Bid Values in tabular form.
a. Provide and identify separate columns to indicate the following;
1) SPECIFICATION SECTION.
2) DESCRIPTION.
3) RESPONSIBLE PARTY.
4) MAJOR SCOPE.
5) DOLLAR VALUE.
6) PERCENTAGE OF THE CONTRACT SUM.
b. Provide and identify separate line-items to indicate the following;
1) Activity.
2) Contract Conditions.
3) Allowance(s).
4) Contingency (ies).
5) Grand Totals.

B. Content:
1. SPECIFICATION SECTION: Use the specification section number in the Project Manual Table of Contents to identify and establish each line-item.
2. DESCRIPTION: Provide a description of the work for each line-item associated with the specification section and responsible party.
3. RESPONSIBLE PARTY: Identify the party responsible for performing the work of each line-item associated with the specification section and description.
4. MAJOR SCOPE: Designate Major scope of work as identified and itemized in BID PROPOSAL.
a. Provide separate columns for each Major Scope of Work identified.
5. DOLLAR VALUE: Sub-Total of the cost for each activity line-item, with the amounts rounded to the nearest dollar.
a. Assign a dollar value for each line-item to each Major Scope of the project excluding General Conditions, General Requirements and General Contractor’s Overhead and Profit.
6. PERCENTAGE OF THE CONTRACT SUM: Dollar Value as a percentage of the Contract Sum to the nearest one-hundredth percent, adjusted to total one hundred percent.
7. Activity: Provide at least one activity item-line for the work in each Specification Section.
a. Provide separate activity line items for each Contractor or Subcontractor providing work under the same specification section.
8. Contract Conditions:
a. Identify and provide separate activity line-item for cost items that are directly related to Division 01 - GENERAL REQUIREMENTS.
b. Identify and provide separate activity line-item for cost items that are directly related to Division 00 - CONDITIONS OF THE CONTRACT.
9. Allowances: Identify and provide separate activity line-item for each Allowance that is assigned for specific work in any specification section. Dollar value to exclude General Contractor's Overhead and Profit.
10. Contingencies: If required, identify and provide separate activity line-item for each Contingency that is not assigned to specific work in any specification section. Dollar value to exclude General Contractor's Overhead and Profit.

a. If required, provide separate line items for Owner Contingency and Contractor Contingency.

11. Grand Total: Summation of dollar value for each column equal to the Bids received.

2.3 COMPLETE SCHEDULE OF VALUES

A. Format:

1. Provide a comprehensive, fully developed, detailed Complete Schedule of Values in tabular form.
   a. Provide and identify the following separate columns to indicate the following for each item listed;
      1) SPECIFICATION SECTION.
      2) ACTIVITY CODE.
      3) DESCRIPTION.
      4) RESPONSIBLE PARTY.
      5) MAJOR SCOPE.
      6) SCOPE TYPE.
      7) DOLLAR VALUE.
   b. Provide and identify separate line-items to indicate the following;
      1) Activity.
      2) Sub-Schedules.
      3) Contract Conditions.
      4) Allowances.
      5) Purchase Contracts.
      6) Contingencies.
      7) Grand Totals.

B. Content:

1. SPECIFICATION SECTION: Use the specification section number in the Project Manual Table of Contents to identify and establish each line-item.
2. ACTIVITY CODE: Provide the Activity Identification Code for each line-item indicated as separate activities in the Baseline Project Construction Schedule.
3. DESCRIPTION: Provide a description of the work for each line-item associated with the specification section and responsible party.
4. RESPONSIBLE PARTY: Identify the party responsible for performing the work of each line-item associated with the specification section and description.
5. MAJOR SCOPE: Designate Major scope of work as identified and itemized in BID PROPOSAL
6. SCOPE TYPE: Identify each line-item that is associated with a segment of work.
7. DOLLAR VALUE: Sub-Total of the cost for each activity line-item, with the amounts rounded to the nearest dollar.
   a. Assign a dollar value for each line-item to each Major Scope of the project excluding General Conditions, General Requirements and General Contractor's Overhead and Profit.
8. Activity: Provide at least one activity item-line for the work in each Specification Section.
   a. Provide separate activity line items for each Contractor or Subcontractor providing work under the same specification section.
   b. Include entities responsible for performing the work of each activity, identified as, but not limited to, General Contractor, and Sub-Contractor, second and tertiary tier Sub-Contractors, Manufacturers, Fabricators and Vendors.
   c. Include separate activity line-items for cost items that are directly related to Division 01 - GENERAL REQUIREMENTS and are direct cost of actual work-in-place. Such items shall be, but not limited to, the following;
      1) Submittals,

2) Field Engineering,
3) Operation and Maintenance Manuals.
4) Demonstration and Training.

9. Sub-Schedules:
   a. Major Scope of Work: Provide Sub-Schedules for line-items that are associated with each designated major scope of work as identified in Bid Proposal, and defined in Specification Section -- SUMMARY OF WORK and Specification Section -- ALTERNATES that requires itemization of each line-item value.
   b. Scope Type: Provide Sub-Schedules for line-items that are associated with each specific scope type.
      1) Building Costs: Detailed cost breakdown of all cost items that are directly related to the Project per Building.
         a) When the Project Building(s) is of sufficient size to warrant, break the building costs down into areas of work compatible with the Contractor's Means and Methods for construction sequences.
         b) Building areas may consist of floor and roof levels and partial floor and roof levels.
      2) Project Site Costs: Detailed cost breakdown of all cost items that are directly related to the Project Site.
         a) When the Project Site is of sufficient size to warrant, break the site costs down into areas of work compatible with the Contractor's Means and Methods for construction sequences.
10. Contract Conditions: As defined in the Schedule of Bid Values and the following;
    a. Expand to include separate activity line-items for cost items that are directly related to Division 01 - GENERAL REQUIREMENTS and are not direct cost of actual work-in-place. Such items shall be, but not limited to, the following;
       1) Temporary Facilities.
       2) Field Supervision.
       3) Project Identification Sign.
       4) Project Closeout Requirements.
          a) Punch List Activities, and Project Record Documents.
    b. Expand to include separate activity line-item for cost items that are directly related to Division 00 - CONDITIONS OF THE CONTRACT REQUIREMENTS and are not direct cost of actual work-in-place. Such items shall be, but not limited to, the following;
       1) On-Site Facilities and Supervision.
       2) General Contractor's Overhead and Profit.
       3) Performance and Labor and Material Bonds.
11. Allowances: Identify and provide separate activity line-item for each Allowance that is assigned for specific work in any specification section. Dollar value to exclude General Contractor's Overhead and Profit..
12. Purchase Contracts: Provide separate line-item in the Schedule of Values for each Purchase Contract, showing the value of the Purchase Contract.
13. Contingencies: If required, identify and provide separate activity line-item for each Contingency that is not assigned to specific work in any specification section. Dollar value to exclude General Contractor's Overhead and Profit.
    a. If required, provide separate line items for Owner Contingency and Contractor Contingency.
14. Grand Total: Summation of dollar value for each column equal to the Bids received.

2.4 UNIT PRICES

A. Unit Prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead and profit.

1. Breakdown prices into:
    a. Delivered cost of products(s) including tax.
    b. Total installed cost excluding overhead and profit.
    c. Add Contractor's and subcontractor's overhead and profit costs after subtotal and provide a final total.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of Unit Prices. Methods of measurement and payment for Unit Prices are specified in those sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established Unit Prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to the Contractor.

PART 3 - EXECUTION

3.1 APPLICATION AND CERTIFICATION FOR PAYMENT

A. General Requirements:

1. Coordination: Coordinate the preparation of the Application for Payment with the preparation of the Complete Schedule of Values and Project Construction Schedule.
    a. Entries shall match data on the Complete Schedule of Values and Project Construction Schedule and Project Schedule Updates, if revisions were made.
2. Application and Certification for Payment Forms: Use forms accepted by the Architect and Owner for Applications for Payment.
    a. Form shall be based on AIA Document G702 Application and Certification for Payment and AIA Document G703 Continuation Sheets.
    b. Submit form for acceptance with initial submittal of Complete Schedule of Values.
3. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of the Contractor. Project Inspector or Architect will return incomplete applications without action.
    a. Use signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt. One copy shall include Waivers of Lien and similar attachments if required.
4. Identification: Include the following Project Identification on all Application for Payment:
    a. Project Name and Location.
    b. Owner Name.
    c. Architect's Project Number.
    d. Contractor Name and Address.
    e. Application Number.
    f. Application Date.
    g. Period To:

B. Format.

1. Provide a comprehensive, fully developed, detailed Application for Payment with Continuation Sheets in tabular form.
    a. Provide and identify the following separate columns to indicate the following for each item listed;
        1) ACTIVITY CODE.
        2) DESCRIPTION.
        3) SCHEDULED DOLLAR VALUE.
        4) WORK COMPLETED.
            a) FROM PREVIOUS APPLICATION.
            b) THIS PERIOD.
        5) TOTAL COMPLETED.

6) PERCENTAGE OF COMPLETION.
7) BALANCE TO FINISH.
8) RETAINAGE.

b. Provide and identify separate line-items to indicate the following the following;
1) Activity.
2) Sub-Schedules.
3) Contract Conditions.
4) Allowance(s).
5) Purchase Contracts (if applicable).
6) Contingency (ies).
7) Grand Totals.
8) Change Orders.

C. Content:
1. ACTIVITY CODE: Provide the Activity Identification Code for each line-item of Work as indicated as separate activities in the Project Construction Schedule.
2. DESCRIPTION OF WORK: Provide the same description as indicated in the Schedule of Values for each line item.
3. SCHEDULED DOLLAR VALUE: Provide the same amount as indicated in the Schedule of Values for each line item.
4. WORK COMPLETED: with the following sub-columns.
a. FROM PREVIOUS APPLICATION, include Dollar Value for work completed in previous Application for Payment, whether or not payment has been received.
b. THIS PERIOD, include only the Dollar Value for work completed at the time of Application for Payment.
5. TOTAL COMPLETED: The sum Dollar Value of Work Completed and Materials Presently Stored.
6. PERCENTAGE OF COMPLETION: The percentage value of the total Work Completed and the Stored to Date divided by the Scheduled Value.
7. BALANCE TO FINISH: The dollar value of the Scheduled Value minus the Total Completed.
8. RETAINAGE: The dollar value of the percentage of retention per contract agreement.
9. Activity:
a. Use the Complete Schedule of Values and Baseline Project Schedule as a guide to establish activity line-items for the Application for Payment.
b. Include separate activity line-items when a work activity is separated into stages and requires separate payments for each stage.
c. Provide separate line-items for each part of the Work where separate payments will be requested including, but not limited to, submittals, materials, equipment, fabrication and installation.
d. Provide separate line items for materials stored but not yet installed, where separate payments will be requested.
10. Sub-Schedules: As described in the Complete Schedule of Values.
11. Contract Conditions: As described in the Complete Schedule of Values.
12. Allowances: As described in the Complete Schedule of Values.
13. Purchase Contracts: As described in the Complete Schedule of Values
a. Indicate Owner payments or deposits, if any, and balance to be paid by the Contractor.
14. Contingencies: As described in the Complete Schedule of Values.
15. Grand Totals: As described in the Complete Schedule of Values.
16. Change Orders:
a. Include amounts of approved Change Orders or Construction Change Directives issued before the last day of construction period covered by application.

D. Supplemental Information:

1. Materials Stored: Include in Application for Payment the amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed.
    a. Differentiate between items stored on-site and items stored off-site.
    b. Provide certificate of insurance or Bonded Warehousing, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
    c. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
    d. Provide summary documentation for stored materials indicating the following:
        1) Materials previously stored and included in previous Applications for Payment.
        2) Work completed for this Application utilizing previously stored materials.
        3) Additional materials stored with this Application.
        4) Total materials remaining stored, including materials with this Application.
2. Waivers of Mechanic's Lien: With each Application for Payment, submit Waivers of Mechanic's Liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
    a. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
    b. When an Application shows completion of an item, submit conditional final or full waivers.
    c. Owner reserves the right to designate which entities involved in the Work must submit waivers.
    d. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
    e. Waiver Forms: Submit waivers of lien on forms executed in a manner acceptable to Owner.

E. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for payment include the following:
1. List of Subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. Products List (preliminary if not final).
5. Schedule of Unit Prices.
6. Submittal Schedule (preliminary if not final).
7. List of Contractor's Staff Assignments.
8. List of Contractor's Principal Consultants.
9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
10. Initial Progress Report.
11. Report of Preconstruction Conference.

F. Application for Payment for Progress of Work:
1. Each Application for Payment shall be consistent with previous applications and payments as certified by the Project Inspector, Architect, and paid for by the Owner.
2. Payment Applications shall be submitted to the Architect by the date established by the Owner. The maximum period of time covered by each Application for Payment is for one month.
3. Payments Applications shall be updated to reflect any revised activity in the Project Schedule Updates.

G. Application for Payment at Substantial Completion: After the issuing of the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portions of the Work claimed as substantially complete.
1. Include documentation supporting the claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

H. Final Application for Payment: Submit Final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement accounting for final changes to the Contract Sum.
4. "Contractor's Affidavit of Payment of Debts and Claims."
5. "Contractor's Affidavit of Release of Liens."
6. "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

3.2 SCHEDULE OF UNIT PRICES

A. Specification Section - CAST-IN-PLACE CONCRETE:
1. Concrete slabs per thickness per square foot.
2. Concrete foundations per cubic yard.
3. Concrete walls per cubic yard.

B. Specification Section - PLUMBING:
1. Utility trenching, pipe placement and backfill per pipe diameter size per linear foot at specific trench depths.

C. Specification Section - ELECTRICAL:
1. Utility trenching, sleeve pipe or conduit pipe placement and backfill per pipe diameter size per linear foot at specific trench depths.

D. Specification Section - COMMUNICATIONS:
1. Utility trenching, sleeve pipe or conduit pipe placement and backfill per pipe diameter size per linear foot at specific trench depths.

E. Specification Section - ELECTRONIC SAFETY AND SECURITY:
1. Utility trenching, sleeve pipe or conduit pipe placement and backfill per pipe diameter size per linear foot at specific trench depths.

F. Specification Section - EARTHWORK:
1. Scarification and compaction of existing soil per cubic yard.
2. Excavation and compacted placement of existing suitable site soil for non-engineered fill per cubic yard.
3. Delivery and compacted placement of import soil per cubic yard.
4. Delivery and compacted placement of import soil for grading per cubic yard.
5. Rough grading per square foot.
6. Finish grading per square foot.

G. Specification Section - STORM DRAINAGE:
1. Delivery and installation of catch basins per individual catch basin size.
2. Trenching, pipe placement and backfill per pipe diameter size per linear foot at specific trench depths.
3. Miscellaneous storm drainage items per item.

END OF SECTION

SECTION 01 31 13 – CONTRACTOR'S PROJECT MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the administrative and procedural provisions for construction operations.

B. Related Sections:

1. DIVISION 00 SPECIFICATION SECTIONS, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 DEFINITIONS

A. BIM: Building Information Modeling.

B. CAD: Computer Aided Design and Drafting.

C. RFI: Request for Information. Seeking information required by or clarifications of the Contract Documents.

D. MINUTES: A method of documenting key topics discussed with a focus on decisions made and directions given and by whom during a meeting. A verbatim transcript is not necessary.

1.3 SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.

B. Key Personnel Names: Within fifteen (15) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities, list telephone numbers, and e-mail addresses. Provide names, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project. Keep list available and current at all times.

1.4 COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in the Contract Documents to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

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B. Coordination of Multiple Contracts: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its own operations with operations included in the Contract Documents that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

D. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

E. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.

1.5 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Architect's Data Files Not Available: Architect will not provide Architect's CAD drawing digital data files for Contractor's use during construction.

B. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings will be provided by Architect, if available, for Contractor's use during construction, as per written request made by the Contractor.
   1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
   2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
   3. Digital Drawing Software Program: Contract Drawings are available in Auto CAD.
   4. Contractor, and other parties granted access by Contractor to Architect's digital data files, shall execute attached data licensing agreement form "USER AGREEMENT FOR ELECTRONIC FILES."

C. Web-Based Project Management Software Package: Use of Contractor' web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion, is acceptable.
   1. Web-based Project management software includes, at a minimum, the following features:

a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
c. Document workflow planning, allowing customization of workflow between project entities.
d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
e. Track status of each Project communication in real time, and log time and date when responses are provided.
f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
g. Processing and tracking of payment applications.
h. Processing and tracking of contract modifications.
i. Creating and distributing meeting minutes.
j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
k. Management of construction progress photographs.
l. Mobile device compatibility, including smartphones and tablets.

2. Provide up to seven (7) Project management software user licenses for use by users as identified by Owner and Architect.
3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

D. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with bookmarks enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.
4. Do not submit password protected documents or restricted documents.

1.6 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. RFIs submitted to Architect by other parties controlled by Contractor will be returned without response.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in work.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
2. Owner name.
3. Owner's Project number.
4. Name of Architect.
5. Architect's Project number.
6. Date.
7. Name of Contractor.
8. RFI number, numbered sequentially.

9. RFI subject.
10. Specification Section number and title and related paragraphs, as appropriate.
11. Drawing number and detail references, as appropriate.
12. Field dimensions and conditions, as appropriate.
13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
14. Contractor's signature.
15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Use forms accepted by the Architect and Owner. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven (7) days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal.
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within five (5) days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include not less than the following:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number, including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three (3) days if Contractor disagrees with response.

1.7 COORDINATION DRAWINGS

A. Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
   a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
   b. Coordinate the addition of trade-specific information to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
   c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
   d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
   e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
   f. Indicate required installation sequences.
   g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
2. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Above Ceiling: Indicate subframing for support of ceiling**,** and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenums to accommodate layout of light fixtures, fire sprinklers, mechanical ducts, support structures, structural elements (beams, joist, trusses) and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.

c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inchesin diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
   c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Fire-Protection System: Show the following: Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Site Utility Coordination: Show the following:
   a. Existing and proposed underground and surface utility improvements including gas, domestic water, fire water, chilled water, hot water, irrigation, storm sewer, sanitary sewer, electrical power, and communications. No site improvements shall be installed prior to Architect's and Owner's review of coordination drawing. Architect's and Owner's review is only for general conformance with the Contract Documents. Contractor is responsible to obtain their own GPR Services to locate utilities within the construction site area.

C. Coordination Drawing Process: Prepare coordination drawings in the following manner:
1. Schedule submittal and review of Structural Steel, Wood Framing, Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.
2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
4. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.
5. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
6. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.

D. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format:
   a. Same digital data software program, version, and operating system as original Drawings, operating in Microsoft Windows operating system.
2. File Submittal Format: Submit or post coordination drawing files using PDF format, or in a format as requested by the Architect.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conduct matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
   a. Introductions, responsibilities and personnel assignments.
   b. Tentative construction schedule.
   c. Phasing.
   d. Critical work sequencing and long lead items.
   e. Designation of key personnel and their duties.
   f. Lines of communications.
   g. Use of web-based Project software.
   h. Review of General Conditions/Requirements.
   i. Procedures for processing field decisions and Change Orders.
   j. Procedures for RFIs.
   k. Procedures for Submittals.
   l. Procedures for Substitutions.
   m. Procedures for testing and inspecting.
   n. Procedures for processing Applications for Payment.
   o. Distribution of the Contract Documents.
   p. Submittal procedures.
   q. Sustainable design requirements.
   r. Preparation of Record Documents.
   s. Use of the premises.
   t. Work restrictions.
   u. Working hours.
   v. Owner's occupancy requirements.
   w. Responsibility for temporary facilities and controls.
   x. Procedures for moisture and mold control.
   y. Procedures for disruptions and shutdowns.
   z. Construction waste management and recycling.
   aa. Parking availability.
   bb. Office, work, and storage areas.
   cc. Equipment deliveries and priorities.
   dd. Project Safety.
   ee. Security.
   ff. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Owner and Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility requirements.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conduct matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
   a. Preparation of Record Documents.
   b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
   c. Procedures for completing and archiving web-based Project software site data files.
   d. Submittal of written warranties.
   e. Requirements for preparing operations and maintenance data.
   f. Requirements for delivery of material samples, attic stock, and spare parts.
   g. Requirements for demonstration and training.
   h. Preparation of Contractor's punch list.
   i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.

j. Submittal procedures.
k. Coordination of separate contracts.
l. Owner's partial occupancy requirements.
m. Installation of Owner's furniture, fixtures, and equipment.
n. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at weekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conduct matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      1) Review schedule for next period.
   b. Review present and future needs of each entity present, including the following:
      1) Interface requirements.
      2) Sequence of operations.
      3) Status of submittals.
      4) Status of sustainable design documentation.
      5) Deliveries.
      6) Off-site fabrication.
      7) Access.
      8) Site use.
      9) Temporary facilities and controls.
      10) Progress cleaning.
      11) Quality and work standards.
      12) Status of correction of deficient items.
      13) Field observations.
      14) Status of RFIs.
      15) Status of Proposal Requests.
      16) Pending changes.
      17) Status of Change Orders.
      18) Pending claims and disputes.
      19) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: Each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conduct matters relating to the Work. Advise Owner and Architect of scheduled meeting dates.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each contractor present, including the following:
        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site use.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Status of RFIs.
        14) Proposal Requests.
        15) Change Orders.
        16) Pending changes.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS
NOT APPLICABLE

PART 3 - EXECUTION
NOT APPLICABLE

END OF SECTION

USAGE AGREEMENT FOR ELECTRONIC FILES
Release of Liability

Documents Transmitted By: **Darden Architects, Inc.**
6790 N. West Ave.
Fresno CA 93711

PROJECT NAME: _____

ARCHITECT PROJECT NO.: _____

PROJECT ARCHITECT: _____

I _____, as a duly authorized agent of_____ - (Contractor) have an agreement for construction services on the above named project. The Contractor acknowledges having received at least one (1) complete set of Contract Documents for the project and has posted all Addenda and all other contract documents issued to date.

The Contractor is requesting the electronic CAD files of work prepared by the Architect and/or Architect's Consultants (Design Team) on the subject project, so that the information therein may be utilized in the Contractor's work on the same project. The Contractor understands that these files are being provided as a courtesy and they are strictly intended for the Contractor's sole convenience and they are not recognized Contract Documents. This request is subject to the following conditions, which the Contractor hereby agrees to abide by:

1. It is understood and agreed to that any files and/or documents provided are instruments of professional service by the Design Team and are intended for one-time use solely in the construction of this project. They are and shall remain the property of the Architect or the Architect's Consultants, who is deemed to be the author of the drawings and data, and who shall retain all common law, statutory law, and all other rights, including copyrights.

2. The Contractor shall indemnify and hold harmless, the Design Team, its officers, directors, employees or subcontractors, to the fullest extent permitted by law, against all claims, liabilities, losses, damages, and costs, including but not limited to attorney's fees and defense costs arising out of or resulting from contractor's use of these electronic files, or in any way connected with the modification, misinterpretation, misuse, or reuse by the Contractor or by others.

3. The Contractor agrees that by using these electronic files, the Contractor is in no way relieved of the duty to fully comply with the Contract Documents, including and without limitation, the need to check, confirm and coordinate all dimensions and other details, take field measurements, verify field conditions and coordinate with all other contractors for the project.

4. It is agreed to that these electronic files are not Contract Documents. Differences may exist between electronic files and corresponding hard-copy Contract documents. The Design Team makes no representation regarding the accuracy or completeness of the electronic files provided to the contractor. In the event that a conflict arises, the signed and sealed hard-copy Contract Documents shall govern. Contractor is responsible for determining if any conflict exists.

5. The Contractor understands that the Design Team makes no representation as to the compatibility of these files with Contractor's computer hardware or software. The Contractor understands that the accuracy of the information is an artifact of the techniques used to generate it and is in no way

intended to imply actual accuracy. It is also understood that the automated conversion of information and data from the system and format used by the Design Team to an alternate system or format cannot be accomplished without the possibility of introduction of inexactitudes, anomalies and errors.

6. Because information presented on the electronic files can be modified, unintentionally or otherwise, the Design Team reserves the right to edit the drawings to remove information deemed not necessary and/or remove all indications of ownership and/or involvement from each electronic display.

7. The Design Team will only furnish those drawings directly applicable to the shop drawings the contractor wishes to create. The Contractor understands that not all electronic files may be available at the Design Team's discretion.

8. The Contractor understands that the Architect's Consultants may have Additional Conditions for release of their electronic files or documents, and the Contractor hereby agree to abide by the Consultants conditions in addition to the stated conditions in this agreement. Additional Conditions (if any) are attached to this agreement.

9. The Contractor understands that the Architect and the Architect's Consultants will incur certain costs in providing the requested electronic files. The Contractor agrees to pay the Design Team a service fee of $120.00 per sheet, per delivery, prior to any delivery of the electronic files to compensate the Design Team for the labor to prepare and transmit the files and for the additional risk that this transfer will occasion.

10. Under no circumstances shall delivery of the electronic files for use by the Contractor be deemed a sale by the Owner, the Design Team, or any member of the Design Team. The Design Team makes no warranties, either expressed or implied, of merchantability or fitness for any particular purpose. In no event shall the Design Team be liable for any loss of profit or any consequential damages as a result of Contractor's use or reuse of the electronic files.

Darden Architects, Inc.

Description of the requested documents and/or CAD files:

___ Civil ___ Structural ___ Mechanical ___ Electrical ___ Other(s)

_____

_____

_____

_____

_____ _____

Printed Name Title

_____ _____

Signed Dated

© Darden Architects, Inc.

SECTION 01 32 16 – CONSTRUCTION SCHEDULES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   a. Project Construction Schedules.
   b. Coordination Schedules.
   c. Schedule Modifications.
   d. Time Extensions.

B. Related Requirements:
   1. 01 11 13 SUMMARY OF WORK.
   2. 01 29 73 SCHEDULE OF VALUES.
   3. 01 33 00 SUBMITTAL PROCEDURES.
   4. 01 41 00 REGULATORY REQUIREMENTS.
   5. 01 45 23 TESTING AND INSPECTION SERVICES.

1.3 DEFINITIONS

A. The following definitions or terms apply to this specification section:
   1. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
      a. Critical Activity is an activity on the critical path that must start and finish on the planned early start and finish times.
      b. Predecessor Activity is an activity that precedes another scheduled activity.
      c. Successor Activity: An activity that follows another scheduled activity.
   2. Activity Code: Identifies each activity so as to be organized, group and sorted into Sub-Schedules, Areas of Work, and Reports.
   3. Construction Schedule: A logical analysis listing the project's milestones, activities, and deliverables with planned dates for performing the scheduled activities and milestones.
   4. Critical Path: The longest continuous chain of activities through the schedule that establishes the minimum overall project duration.
   5. Event: The starting or ending point of an activity.
   6. Float: The measure of leeway in starting and completing an activity.
      a. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is jointly owned, expiring Project resource is available to both parties as needed to meet the schedule milestones and contract completion date.
      b. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
      c. Total float is the measure of leeway in starting of or completing an activity without adversely affecting the planned Project completion date.
   7. Milestone: A key or critical point in time for reference or measurement.
   8. Inclement Weather: Temperature, Precipitation, Fog, and Muddy conditions that may impede the progress of the Project construction on critical activities for more than fifty percent (50%) of the Contractor's scheduled work day.

9. Responsibility Code: Identify entities that are responsible for performing the work of each activity as identified, but not limited to, General Contractor, Sub-Contractor, second and tertiary tier Sub-Contractors, Manufacturers, Fabricators and Vendors.
10. Unusually Severe Weather: The amount of excessive Inclement Weather that is greater than the anticipated number of Inclement Weather days for any given month.
11. Mud Days: The amount of excessive muddy site conditions which prohibit access to and around the Project site, access to buildings and impedes the progress of the Project construction on critical activities as a result of Unusually Severe Weather.
12. NOAA: National Oceanic and Atmospheric Administration.

1.4 SUBMITTALS

A. General:

B. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES.

C. Format for Submittals: A time-scaled bar chart and Gantt-chart-type schedules.
   1. Provide a working electronic copy of schedule file.
   2. Provide schedule files on Compact Disc (CD) or Digital Versatile Disc (DVD) (WINDOWS Formatted Disks) in a form that can reviewed and used by the Owner, and Architect.
   3. Provide PDF electronic copy of schedule file.
   4. Provide (Two) paper copies of schedules.
   5. Sheet size shall of adequate size to clearly show the required information for the entire construction period.
   6. All required documentation shall have the Submittal number posted in the upper-right hand corner of the page.

D. Assurance/Control Submittals:
   1. Project Construction Schedules:
      a. Initial Project Schedule (IPS);
         1) Submit within fourteen (14) days after the Award of Contract.
      b. Baseline Project Schedule (BPS);
         1) Submit within[twenty-one (21) days after the Notice to Proceed date.
         2) Sub-Schedules;
         3) Submit as requested by Architect or Owner.
   2. Coordination Schedules:
      a. Short Interval Schedules (SIS);
         1) Submit at the regularly scheduled meetings.
      b. Monthly Schedule Updates (MSU);
         1) Submit seven (7) days prior to the designated regularly scheduled monthly Progress Meeting for Schedule Review.
         2) Submit the agreed upon MSU one week prior to monthly progress payments.
   3. Schedule Modifications:
      a. Change in Sequence;
         1) Submit as needed at a regularly scheduled Progress Meeting.
      b. Recovery Schedule;
         1) Submit as needed at a regularly scheduled Progress Meeting.
      c. Alterations to Schedule;
         1) Submit as needed at a regularly scheduled Progress Meeting
   4. Time Extension Requests:
      a. Notice of Delay;
         1) Submit within seven (7) days after a delay event, and/or with a Change Order Request (COR) that is in response to a CCD, RFP, or other documents issued by the Architect.
      b. Inclement Weather;

1) Submit within twenty-four (24) hours after an event.

1.5 SYSTEM DESCRIPTION

A. General:

1. The Architect considers the project schedule requirements to be of significant importance to both the Contractor and the Owner. The development, submittal, acceptance and maintenance of the Initial Project Schedule, Baseline Project Schedule and subsequent Monthly Schedule Updates must be given high priority.
   a. Progress payments may be withheld in whole or part should the Contractor fail to comply with the requirements of this section.
   b. No separate payment will be made to the Contractor for any of the requirements of this section. All such costs shall be part of the Contractor's planned project overhead costs included in its bid.

B. Performance Requirements:

1. The Baseline Project Schedule shall be the basis for evaluating the job progress and time extension requests. The responsibility for developing the Baseline Project Schedule, accurately updating the schedule, and monitoring the actual progress of the work compared to the planned schedule rests solely with the Contractor.
   a. Failure of the Contractor to include any element of the work or any inaccuracy in the Baseline Project Schedule will not relieve Contractor from the responsibility for accomplishing all the work in accordance with the Contract requirements.
2. Inclement Weather: The Contractor shall have included all impacts to weather dependent activities, resulting from the anticipated Inclement Weather in the Baseline Project Schedule.
   a. Contractor shall be responsible for all associated time delays and costs.
   b. Contractor shall be responsible to account for associated mitigating measures which includes, but not limited to, dewatering, mucking, temporary weather protection, gravel roadways, equipment downtime, etc.
   c. Contractor shall be responsible to account for the site's soil conditions, drainage patterns, and other elements that may be affected.
3. Cost Correlation: The Initial Project Schedule and the Baseline Project Schedule shall be the basis for developing the Schedule of Values and the Work performed as of planned and actual dates used for preparation of The Application for Payment Requests.
   a. Refer to Specification Section - SCHEDULE OF VALUES.
4. Early Completion Schedules: Early completion schedules may be prohibited due to certain physical or monetary constraints imposed upon the Owner.
   a. If not prohibited, and is contemplated by the Contractor as part of its bidding strategy, it is hereby expressly understood by the Contractor that early completion schedules will only be acceptable under the condition that the schedule be reasonable and realistic.
   b. The Contractor certifies that it has included general conditions costs in its bid sufficient for the entire contractual time of performance.
   c. No damages for delay will be recoverable if the project is prolonged beyond the early completion date, but still completed within the entire contract duration.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. The Contractor must have the capacity and capability of supporting the project by producing schedule-related data within two (2) days of request by the Contractor, Architect, or Owner.

B. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS.

C. Meetings:

1. Prescheduling Conference: Scheduled by the Contractor prior to submitting the Baseline Project Schedule, unless otherwise agreed to by the Architect and Owner, for the proper coordination of the work. Conduct conference at Project site. Review methods and procedures related to the Baseline Project Schedule, including, but not limited to, the following:
   a. Review delivery dates for Owner-Furnished products.
   b. Review schedule for work of Owner's separate contracts.
   c. Review submittal requirements and procedures.
   d. Review time required for review of submittals and resubmittals.
   e. Review requirements for test and inspections by independent testing and inspection agencies.
   f. Review time required for Project closeout and Owner startup procedures**,** **[**including commissioning activities].
   g. Review and finalize list of construction activities to be included in schedule.
   h. Review procedures for updating schedule.
2. Progress Meetings: Scheduled by the Contractor for the proper coordination of the work.
   a. Weekly Progress Meeting: Schedule on a weekly basis, unless otherwise agreed to by the Architect and Owner;
      1) Review Short Interval Schedule.
      2) Discuss field observations, problems, and decisions.
   b. Monthly Schedule Update: Designate a regular monthly meeting to address and resolve all schedule issues for the prior month;
      1) Identification of any potential problems which may impede planned progress.
      2) Corrective measures to regain projected schedules.
3. Participants (or designated representative) invited to attend each of the above meetings shall be as follows:
   a. Contractor.
   b. Owner.
   c. Architect.
   d. Project Inspector.
   e. Installer(s), as appropriate.
   f. Material Manufacturer(s), as appropriate.
   g. Subcontractors, as appropriate (including any accessory subcontractors).

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Time Frame: Extend schedules from dates established from the Notice to Proceed to final completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date.

B. Activity Data: Schedule to show early start, early finish, late start, late finish, original duration, remaining duration, total float and percentage completion.
   1. Contractor shall submit a detailed BPS presenting an orderly and realistic plan for the completion of the entire project.
      a. The BPS shall not show more than 10% of the total activities as critical.
      b. The BPS shall not show more than 20% of the activities with total float of 10 working days or less.
      c. The schedule shall not show any activities with negative float.
      d. Start and Finish constraints, unless identified in the contract documents, shall be minimized as much as possible.

2. Schedule activities that are dependent on submittal approval and/or material delivery. Activities shall not be scheduled to start earlier than the reasonably expected review, and acceptance or delivery dates.
    a. Coordinate Submittal Schedule with the list of subcontractors, and the list of products.
    b. Prepare the schedule in chronological order. Provide information as called for in Specification Section - SUBMITTAL PROCEDURES.
    c. Submittal Review Time: Include review and resubmittal times indicated in Specification Section - SUBMITTAL PROCEEDURES in schedule.

C. Activity Duration: Activity durations shall be the total number of days required to perform that activity.
1. Define activities so no activity is longer that twenty (20) days, unless specifically allowed by Architect, except for submittal, approval, fabrication and delivery (procurement) activities
2. Activities that require three months or longer to complete, indicate an estimated completion percentage in ten (10) percent increments within the time bar.
3. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than sixty (60) days, as separate activities in schedule.
    a. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery
4. Startup and Testing Time: Include no fewer that fifteen (15) days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than thirty (30) days for completion of punch list items and final completion.

D. Constraints:
1. Constraints: Include constraints and work restriction indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
    a. Phasing: Arrange list of activities on schedule by phase as indicated in Specification Section – SUMMARY OF WORK
    b. Include a Separate activity for each of the following:
        1) Work under More Than One Contract.
        2) Work Performed By Owner.
        3) Each Product Ordered In Advance, include delivery dates.
        4) Each Owner-Furnished Product, include the delivery dates.
    c. Work Restrictions: Show the effect of the following items on the schedule:
        1) Coordination with existing construction.
        2) Limitations of continued occupancies.
        3) Uninterruptible service.
        4) Partial occupancy before Substantial Completion.
        5) Use of premises restrictions.
        6) Provisions for future construction.
        7) Seasonal variations.
        8) Environmental control.
    d. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
        1) Submittals.
        2) Purchases.
        3) Mockups
        4) Fabrication
        5) Sample Testing.

6) Deliveries
7) Installation
8) Test and inspections

e. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities.

E. Inclement Weather: The schedules shall include delays due to the effect of the anticipated Inclement Weather, including resultant muddy conditions, in all-weather dependent activities.

1. The Contractor shall submit with the Baseline Project Schedule, a National Oceanic and Atmospheric Administration (NOAA) Meteorological Data Chart showing the "Normals," "Means," • and "Extremes," • of monthly Temperature, Precipitation, and Fog for the area where the project is located.
   a. The Owner reserves the right to update Meteorological Data, so that it reflects the most accurate data for the project site, site conditions and locality.
2. Upon review and acceptance, the Meteorological Data Chart shall be the baseline for evaluating anticipated weather related delays. Refer to the "sample" Meteorological Data Chart provided herein.
   a. Provide the number of delay days of anticipated Inclement Weather in the schedule per month.
   b. Provide the number of delay days of anticipated Mud Days in the schedule per month.
      1) Not all Mud Days are eligible for delays, only a portion of the actual Mud Days will be considered.
      2) Mud Days shall be based on a percentage of actual precipitation days. Upon review and found acceptable, the percentage shall be applied to actual precipitation that are above and beyond the anticipated Inclement Weather.
      3) It is the Contractors obligation to become aware of the site soil conditions, drainage patterns, and other elements that may affect the resulting impacts due to Mud Provide.

F. Project Information:

1. Identification: Include the following Project Identification on all Project Construction Schedules, Coordination Schedules, Schedule Modifications and Time Extension Requests.
   a. Project Name and Location.
   b. Name of Owner and Address.
   c. Name of Architect and Address.
   d. Architect's Project Number.
   e. Contractor's Name and Address.
   f. Submittal Date.

2.2 INITIAL PROJECT SCHEDULE (IPS)

A. Format:

1. Prepare in form of a summary level horizontal-box-column Bar-Chart Schedule:
   a. Provide and identify separate columns to indicate the following;
      1) SPECIFICATION SECTION.
      2) DESCRIPTION.
      3) RESPONSIBILITY CODE.
      4) HORIZONTAL TIME SCALE.
   b. Provide and identify separate activity line-item horizontal bars to indicate the following;
      1) Activity.
      2) Milestones.
      3) Contract Conditions.

B. Content:

1. SPECIFICATION SECTION: Use the specification section number in the Project Manual Table of Contents to identify and establish each line-item.
2. DESCRIPTION: Provide a description of the work for each line-item associated with the specification section and responsible party.
3. RESPONSIBILITY CODE: Provide responsibility code that identifies the responsible party for performing the work of each activity line-item associated with the specification section and description.
4. HORIZONTAL TIME SCALE: Identify the week, month and year. Indicate the first work day of each week with a continuous vertical line.
    a. Extend from the date established from the Notice to Proceed to the date of Final Completion.
5. Activity: Provide a summary level bar chart with distinct graphic delineation for each activity line-item.
    a. Provide at least one activity line-item for the work in each Specification Section.
        1) Provide separate activity line items for each Contractor or Subcontractor providing work under the same specification section.
    b. Organize activities in chronological order by the beginning of each Activity.
6. Milestones: Include initial milestones with dates for the Notice to Proceed, Project Start, Substantial Completion, and Final Completion.
7. Contract Conditions:
    a. Identify and provide separate activity line-items that are directly related to Division 01 - GENERAL REQUIREMENTS.
    b. Identify and provide separate activity line-items that are directly related to Division 00 - CONDITIONS OF THE CONTRACT.

2.3 BASELINE PROJECT SCHEDULE (BPS)

A. Format:
1. Provide a comprehensive, fully developed, detailed, and complete horizontal Gantt-Chart type schedule based on the Initial Project Schedule.
    a. Provide and identify separate columns to indicate the following:
        1) ACTIVITY CODE.
        2) SPECIFICATION SECTION.
        3) DESCRIPTION.
        4) RESPONSIBLE CODE.
        5) HORIZONTAL TIME SCALE.
    b. Provide and identify separate line-item horizontal bars to indicate the following:
        1) Activity
        2) Sub-Schedules
        3) Milestones
        4) Contract Conditions

B. Content:
1. ACTIVITY CODE: Assign Activity Codes that identifies each separate activity line-item to allow the following, but not limited to, to be appropriately sort and grouped into Sub-Schedules, Major Areas of Work, and Reports:
    a. "construction area," "trade" or "submittal/procurement."
2. SPECIFICATION SECTIONS: As described in the Initial Project Schedule.
3. RESPONSIBLE CODE: As described in the Initial Project Schedule.
4. HORIZONTAL TIME SCALE: As described in the Initial Project Schedule.
5. Activity: As describe in the Initial Project Schedule and expand to provide a detailed level bar chart with distinct graphic delineation for each activity line-item.
    a. expand to include entities, which are responsible for performing the work of each activity, identified as, but not limited to General Contractor, and Sub-Contractor, second and tertiary tier Sub-Contractors, manufactures, fabricators and vendors.

b. Include activities for planned mobilization and sequence of early operations

6. Sub-Schedules: Sub-Schedules shall include, but not be limited to, the following:
   a. Major Scope of Work: Identify each major area of construction for each major portion of the Work.
      1) Include, but not limited to, the following: Phasing, Alternates, Construction Phases and funding Criteria.
   b. Scope Type: Identify each major area of construction for each major portion of the Work, such as:
      1) Site Utilities
      2) Site Development Zones
      3) Buildings.
         a) If necessary, separate each floor or separate areas of each main elements of the work.
   c. Submittals: Include a separate sub-schedule for all submittal, approval and procurement activities, including owner-furnished items.
      1) Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   d. Testing and Inspection: Include a separate sub-schedule for all required on-site testing, off-site testing, mock-ups, and inspections.
7. Milestones: As describe in the Initial Project Schedule and include other milestones indicated in the Contract Documents and the following interim milestones.
   a. Earthwork.
   b. Building Foundations and slab on grade.
   c. Structural completions.
   d. Partial Occupancy before Substantial Completion.
   e. Temporary Enclosure and Space Conditioning.
   f. Permanent Space enclosure.
   g. Completion of Mechanical.
   h. Completion of Electrical Installation.
   i. Completion of Communication Installation.
   j. Substantial Completion
   k. Finial Completion
   l.
8. Contract Conditions: As described in the Initial Project Schedule and expanded to include separate activity line-items that are directly related to Division 01 - General Requirements and are not of actual work-in-place. Such items shall be, but not limited to the following.
   a. Temporary Facilities.
   b. Field Engineering.
   c. Project Closeout Requirements:
      1) Startup and Testing Time:
      2) Operation and Maintenance.
      3) Demonstration and Training.
      4) Punch List.

PART 3 - EXECUTION

3.1 SCHEDULES AND PROCEDURES FOR CONSTRUCTION SCHEDULES

A. General Requirements:
   1. The Architect may request the Contractor to provide (at no cost) the following additional reports or schedule plots:
      a. Total or Free Float Report from least to most float.

b. Subcontractor Certifications, indicating approval of the subcontractors scheduled work, acknowledging outside factors such as manpower resources, stacking of trades, multiple mobilizations, and coordination of space with other trades and the stacking of trades.

c. Narrative Reports: May include but not limited to the following descriptions;

1) Last month's progress achieved, and anticipated next month's progress.

2) Problems or delays experienced and an explanation of mitigating actions taken.

3) Current or anticipated delays and proposed mitigation action to be taken.

4) Listing of all submittals, RFIs, Change Directives, Owner-supplied equipment or other Owner-controlled and critical constraints affecting the Contractor's progress.

B. Coordination Schedules:

1. Short Interval Schedules (SIS): A look-ahead schedule.

a. Provide a three-week snapshot of the work generated from the most recent monthly Schedule Update.

b. Include the current week, and two week thereafter.

c. The schedule shall contain sufficient detail to evaluate inspection requirements, and for the Contractor to anticipate manpower and equipment needs.

2. Monthly Schedule Updates (MSU): Accurately indicate the actual progress of the work during the prior month.

a. Indicate the date through which progress is reported shall be identified on all update schedule.

1) Provide the actual start and finish dates of activities commenced or completed during the prior month.

2) Once the actual start and finish dates are updated and accepted as accurate, this data shall not be changed. This portion shall be considered an "As-Built."

3) If the schedule data is changed due to a routine updating only, no identification or discussion of such changes is required.

b. The Monthly Schedule Updates shall include the Schedule Modifications and Time Extensions that have been mutual agreed to by the Architect and Contractor.

1) In the event of multiple Schedule Modifications and Time Extensions, events shall be updated into the current Monthly Schedule Update in the actual order of occurrence.

c. The Architect's review comments shall be incorporated into the next update for the Architect's verification.

C. Schedule Modifications:

1. Changes in Sequence:

a. If the Architect determines that the sequence of the construction differs significantly from the Contract schedule, the Contractor shall submit a revised schedule for approval within fourteen (14) days of the Architect's request.

b. If the work is re-sequenced, or if activities are added or deleted, these schedule data changes must be specifically identified, discussed and submitted.

1) The submittal shall be separate and apart from the routine monthly update submittals.

c. If the changes are reviewed and found acceptable, the schedule revision shall be made and incorporated into the project schedule prior to the next Monthly Schedule Update submittal.

1) The Contractor agrees to be bound by the revised, re-sequenced or optimized schedules, and agrees to make no claim for such.

2. Recovery Schedule:

a. When periodic update indicates, the Work is fourteen (14) or more calendar days behind the current approved schedule, submit a separate recovery schedule indication means by which Contractor intends to regain compliance with the schedule.
b. Submittal shall indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
1) The submittal shall be separate and apart from routine monthly update submittals.
c. The Contractor agrees to be bound by the revised, re-sequenced or optimized schedules, and agrees to make no claim for such.

3. Alterations to Schedule:
a. If the Contractor intends to alter its planned sequence or approach to the work, the Contractor shall submit a request of the schedule revisions or sequence changes to the Architect for review and comment.
b. Submittal shall include a description of the reason(s) for the schedule changes, a description of the changes being made, a list of all added and deleted activities, changed logic relationships, changed activity durations or descriptions, etc.
1) The submittal shall be separate and apart from routine monthly update submittals.
c. If the requested changes are reviewed and found acceptable, the schedule revision shall be made and incorporated into the project schedule prior to the next Monthly Schedule Update submittal.
1) The Contractor agrees to be bound by the revised, re-sequenced or optimized schedules, and agrees to make no claim for such.

D. Time Extension Submittals:
1. Notice of Delay:
a. Provide "Notice of Delay" submittal to the Architect for all claimed time extension requests, showing the impact of the delay event on the Project Schedule. Refer to the "sample" "Notice of Delay" form provided herein.
1) Submit as a Change Order Request (COR) in response to an event, SI, RFI, RFP, or other documents issued by the Architect.
2) In cases where the Contractor does not provide "Notice of Delay" submittal for a delay event within the specified time limits, then it is mutually agreed that the delay event has no time impact on the contract completion date (or interim milestones) and no time extension is required
b. The Submittal shall demonstrate the time impact based on the date(s) and durations of the delay event, the status of construction at that point in time, and the affect on the scheduled sequence, progress of the Critical Path Activities and Project Completion.
1) The Submittal shall be based on the latest Monthly Schedule Update.
2) The Submittal shall include all supporting project documentation or delay calculations that establish entitlement and quantify the delay.
3) The Submittal shall demonstrate the activity or activities effects on the total float along the activity path at the time the event occurred.
4) The Contractor must propose possible mitigation plans (sequence changes and any costs) for otherwise critical path delays.
a) The Contractor shall provide an evaluation of the cost of mitigation versus the cost of extended project performance.
c. If the requested changes are reviewed and found acceptable, the schedule revision shall be made and incorporated into the project schedule prior to the next Monthly Schedule Update submittal.

1) Extensions of time for performance will be granted only to the extent that the equitable time adjustment for the activity or activities affected exceeds the total float.
2) The Contractor acknowledges and agrees that mitigation of delays due to delay events may require a change to preferential sequences of work.
   a) The Contractor agrees to be bound by the revised, re-sequenced or optimized schedules, and agrees to make no claim for such.

d. The Owner (or District) shall not be liable for any acceleration costs due to the Contractor's failure to comply with the contract requirements for requesting, documenting and demonstrating that a time extension is required for a delay event.
   1) The Contractor's obligation to timely perform per the schedule will not be excused until time extension requests are reviewed and accepted by the Architect.

2. Inclement Weather Delays:
   a. General:
      1) The Contractor shall record on the Contractor Daily Reports, each occurrence of Inclement Weather and Mud impacts to the progress of scheduled work through the Contract duration.
         a) Inclement Weather days will be counted chronologically from the first to the last day of each month, with each daily incidence of "Inclement Weather" being counted as a whole day.
         b) Each occurrence of Inclement Weather and Mud, must be verified and approved by the Inspector of Record.
   b. Unusually Severe Weather:
      1) Provide "Unusually Severe Weathersubmittal to the Architect for all claimed time extension requests, showing the impact of the delay event on the contract schedule. Refer to the "sample" "Notice of Unusually Severe Weather" form provided herein.
      2) Submit as a Change Order Request (COR).
      3) The submittal shall demonstrate the time impact based on the date(s) and durations of the delay event, the status of construction at that point in time, and the effect on the scheduled sequence and progress of the Critical Path Activities.
         a) The submittal shall be based on the latest Monthly Schedule Update.
         b) The submittal shall include all supporting project documentation or delay calculations that establish entitlement and quantify the number of days of anticipated "Inclement Weather" are exceeded in a given month.
         c) The submittal shall demonstrate the effects on the total float of the Project at the time the event occurred
         d) The submittal shall demonstrate that the delay must be beyond the control and without the fault of negligence of the Contractor
      4) If the requested changes are reviewed and found acceptable, the schedule revision shall be made and incorporated into the project schedule prior to the next Monthly Schedule Update submittal.
         a) The Contractor will become eligible for an excusable, non-compensable time extension for "Unusually Severe Weather."
   c. Mud Days:
      1) Provide "Mud Days" Submittal to the Architect for all claimed time extension requests, showing the impact of the delay event on the contract schedule. Refer to the "sample" "Notice of Mud Days" form provided herein
      2) Submit as a Change Order Request (COR).

3) The Submittal shall demonstrate the time impact based on the date(s) and durations of the delay event, the status of construction at that point in time, and the effect on the scheduled sequence and progress of the Critical Path Activities.
   a) The Submittal shall be based on the latest Monthly Schedule Update.
   b) The Submittal shall include all supporting project documentation or delay calculations that establish entitlement and quantify the number of days of anticipated "Mud Days" are exceeded in a given month.
   c) The Submittal shall demonstrate the effects on the total float of the Project at the time the event occurred.
   d) The Submittal shall demonstrate that the delay must be beyond the control and without the fault of negligence of the Contractor.
4) If the requested changes are reviewed and found acceptable, the schedule revision shall be made and incorporated into the project schedule prior to the next Monthly Schedule Update Submittal.
   a) The Contractor will become eligible for an excusable, non-compensable time extension for "Mud Days."

3.2 SCHEDULES

A. List of attached Forms and Reports.
   1. Meteorological Data Chart.
   2. Notice of Delay Form.
   3. Inclement Weather Form.

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EXAMPLE•
Meteorological Data for Fresno, California
Normals, Means and Extremes

TEMPERATURE (degrees F)					PRECIPITATION***		FOG
	Normal		Extremes				
Month	Daily Max.	Daily Min.	Record Highest	Record Lowest	Mean* Number Calendar / Work	Normal (in)	Mean** Number Calendar / Work
					Days per Month		Days per Month
Jan	54.1	37.4	78	19	7.5/5.4	1.96	11.8/8.4
Feb	61.7	40.5	80	24	7.1/5.1	1.8	6.0/4.3
Mar	66.6	43.4	90	26	7.1/5.1	1.89	1.7/1.2
Apr	75.1	47.3	100	32	4.1/2.9	0.97	0.3/0.2
May	84.2	53.7	107	36	1.9/1.4	0.3	0.1/0.1
Jun	92.7	60.4	110	44	0.7/0.5	0.08	0.0/0.0
Jul	98.6	65.1	112	50	0.2/0.1	0.01	0.0/0.0
Aug	96.7	63.8	111	49	0.3/0.2	0.03	0.1/0.1
Sep	90.1	58.8	111	37	1.0/0.7	0.24	0.1/0.1
Oct	79.7	50.7	102	27	2.2/1.6	0.53	0.9/0.6
Nov	64.7	42.5	89	26	5.2/3.7	1.37	5.8/4.1
Dec	53.7	37.1	76	18	6.7/4.8	1.42	12.1/8.6
Year					44.1/31.5	10.6	38.8/27.7

Source: NOAA, National Oceanic and Atmosphere Administration.

* Precipitation of 0.01 inches or more.

** Heavy Fog visibility 1/4 mile or less.

*** Refer to the term Mud, for mud impacts.

Above data is subject to change, based upon the locality of the project. Contractor shall assemble the data and submit to The Architect for confirmation, review and modifications:

Obtain data from NOAA (828) 271-4800, or the Local Weather Office.
http://www.ncdc.noaa.gov

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NOTICE OF DELAY FORM
Date: _____ Submittal No.: _____
From: Name of Contractor Sheet _____ of _____
To: Darden Architects, 6790 N. West Avenue, Fresno, CA 93711 (559) 448-8051
Description of Delay: By reference to attached schedule, the following delay occurred:
_____
_____
_____
_____ Continued on Sheets ____ of ____
Time Extension Requested:_____ work days x 1.4 = _____ calendar days.
Time Requested for Activity:_____ Time Requested for Project:_____
Related Documents: The following construction documents provide evidence of the delay event:
RFI Nos.: _____ SI Nos.: _____
CCD Nos.: _____ RFP Nos.: _____
Daily Reports Dated:_____ and attached.
Project Correspondence Dated:_____ and attached.
Other Documentation:_____
Schedule-Related Information: By reference to the attached Schedule, provide the following:
Predecessor Activity: _____
Successor Activity: _____
Affected CPM Schedule Activities (list IDs and descriptions):
_____
_____
_____
- THE REST OF THIS PAGE IS INTENTIONALLY BLANK –

INCLEMENT WEATHER FORM
Date: _____
From: Name of Contractor Sheet _____ of _____
To: Darden Architects, 6790 N. West Avenue, Fresno, CA 93711 (559) 448-8051
Description of Delay: the following delay occurred:
_____
_____
_____
_____ Continued on Sheets ____ of ____
Time Extension Requested:_____ work days x 1.4 = _____ calendar days.
Time Requested for Activity:_____ Time Requested for Project:_____
Related Documents: The following construction documents provide evidence of the delay event:
Daily Reports Dated:_____ and attached.
Project Correspondence Dated:_____ and attached.
Other Documentation:_____
Affected CPM Schedule Activities (list IDs and descriptions):
_____
_____
_____

END OF SECTION

SECTION 01 32 26 – FORMS AND REPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Contractor to provide all Forms and Reports as required by the Architect for Administrative Procedures and other related items necessary to document the Project as required by the Contract Documents, including but not limited to those forms provided under this specification section.
   2. CalGREEN Forms:
      a. Contractor shall provide all California Green Building Standards Code Certification Worksheets and other related items necessary to document the Project as required by the AHJ, including, but not limited to, those forms provided under this specification section.
         1) Obtain the latest documents from the California Building Standards Commission; revisions may have been made since the publication of this Project Manual.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS
   2. DIVISION 01 SPECIFICATION SECTIONS
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP

1.2 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Forms and Reports as attached to this section when required by the Architect.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 SCHEDULES

A. Listing of Architect required Forms and Reports
   1. 01 32 26.01-DAILY SUPERINTENDENT'S REPORT
   2. 01 32 26.02-SUBCONTRACTOR'S DAILY REPORT
   3. 01 32 26.03-SHOP DRAWING AND SUBMITTAL TRANSMITTAL
   4. 01 32 26.04-REQUEST FOR INFORMATION (RFI)
   5. 01 32 26.05-SUPPLEMENTAL INSTRUCTIONS (SI)

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6. 01 32 26.06-REQUEST FOR PROPOSAL (RFP)
7. 01 32 26.07-CONSTRUCTION CHANGE DIRECTIVE (CCD)
8. 01 32 26.08-CHANGE ORDER REQUEST REVIEW (COR)
   a. (Review form provided by the Contractor is subject to review and comments by the Owner and Architect).
9. 01 32 26.09-CHANGE ORDER (CO)
10. 01 32 26.10-FRAGNET SUBMITTAL FORM
11. 01 32 26.11-APPLICATION FOR PAYMENT (AP)
12. 01 32 26.12-CONTRACTOR'S TESTING / INSPECTION REQUEST FORM
13. 01 32 26.13-CONTRACTOR'S "DEVIATION NOTICE" INSPECTION REPORT FORM
14. 01 32 26.14-CONTRACTOR'S FINAL INSPECTION REQUEST FORM
15. 01 32 26.15-CONTRACTOR'S PUNCHLIST INSPECTION REQUEST FORM
16. 01 32 26.16-CONTRACTOR'S PUNCHLIST
17. Periodic field reports issued by the Architect and Engineers.
18. Contractor's Punch List Response and Correction form is required for each Punch List Review report, citing the issuing Punch List Review format number(s).
19. Completed Contractor's Punch List and Final Inspection Reports issued by the Architect, Engineers and the Owner.
20. See the attached Forms and Reports suitable for reproduction by the Contractor or Subcontractor.

B. Listing of California Green Building Standards Code Certification Worksheets:
   1. WORKSHEET (WS-1) BASELINE WATER USE
   2. WORKSHEET (WS-2) WATER USE REDUCTION
   3. CONSTRUCTION WASTE MANAGEMENT (CWM) PLAN
   4. CONSTRUCTION WASTE MANAGEMENT (CWM) WORKSHEET
   5. CONSTRUCTION WASTE MANAGEMENT (CWM) ACKNOWLEDGMENT

END OF SECTION

GENERAL CONTRACTOR'S
DAILY SUPERINTENDENT'S REPORT

(JOB NO./REPORT NO.) (DATE/DAY)

(JOB NAME) WEATHER DESCRIPTION

(WORK SHIFT) / FROM / TO (PROJECT MANAGER/SUPERINTENDENT)

PM/	ENGR/	CARPENTERS			LABORERS		CEM FINISHERS			OPER ENGR			
SUPT	TK	FMAN	JRMAN	APP	FMAN	LAB	FMAN	JRMAN	APP	JRMAN	APP	OTHER	TOTAL

CONCRETE: CY TODAY:_____ LOCATION: _____ CY TO DATE: _____

WORK SUMMARY:

DELAYS / WORK RELEASED BY OWNER:

CHANGE ORDERS / EXTRA WORK ORDERS:

INSTRUCTIONS FROM ARCHITECT / OWNER:

MATERIALS / EQUIP. DELIVERED TO JOB:

INSPECTIONS / TESTS PERFORMED

SAFETY / ACCIDENTS:

MAJOR EQUIP. ON SITE:

BACKSIDE OF GENERAL CONTRACTOR'S REPORT

SUBCONTRACTORS ON JOB	NO. OF MEN	FOREMAN'S NAME	WORK DESCRIPTION / LOCATION

MAJOR EQUIPMENT ON SITE:

BACK CHARGES:

REMARKS:

SUBCONTRACTOR'S
DAILY REPORT

PROJECT: DATE:

SHIFT TIME FOREMAN: WEATHER:

WORK DESCRIPTION AND LOCATION:

SUB-SUBCONTRACTOR	CREW SIZE	CRAFT	WORK DESCRIPTION / LOCATION

DELAYS:

CHANGE ORDERS / EXTRA WORK ORDERS:

INSTRUCTIONS RECEIVED FROM GC:	TESTS / INSPECTIONS PERFORMED:
MATERAL / EQUIPMENT DELIVERIES:	MAJOR EQUIPMENT ON SITE:

SAFETY / ACCIDENTS:

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SHOP DRAWING AND SUBMITTAL TRANSMITTAL

DESCRIPTION: **SUBMITTAL NO.:**

SPEC SECTION:

ARCHITECT:
Darden Architects
6790 N. West Ave
Fresno, California 93711

PROJECT:

CONTRACTOR:

SUPPLIER:

Substitution: **Yes:** ☐ **DSA Approval Req'd**

DATE RECEIVED: **NO. RECEIVED:** **DATE RETURNED:**

Contractor Remarks:

Other Required Information: CPM Activity / Submittal Task No.:

Early Start (ES) Date: Late Finish (LF) Date:

WARRANTY: ☐ **O and M MANUALS** ☐ Early Finish (EF) Date: Scheduled Float Time: 0

DESIGN CONSULTANT'S REVIEW:

TRANSMITTED BY ARCHITECT TO: DATE RETURNED:

DATE SENT:

NO. SENT:

Consultants Remarks:

ACTION:

☐ NO EXCEPTION TAKEN RELATIVE TO DESIGN
☐ NO EXCEPTION TAKEN WITH MODIFICATION NOTED
☐ AMEND AS NOTED AND RESUBMIT
☐ REJECTED AND RESUBMIT
☐ SEE ATTACHED LETTER

ARCHITECT'S REVIEW:

Architects Remarks:

ACTION:

☐ NO EXCEPTION TAKEN RELATIVE TO DESIGN
☐ NO EXCEPTION TAKEN WITH MODIFICATION NOTED
☐ AMEND AS NOTED AND RESUBMIT
☐ REJECTED AND RESUBMIT

Approved Substitution ☐

COPIES TO:

DATE RETURNED:

Contractor: **Owner:** **Inspector:** **File:** **Other:**

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darden
architects

6790 N. West Avenue
Fresno, California 93711
Tel: 559.448.8051
Fax: 559.446.1765
www.dardenarchitects.com

REQUEST FOR INFORMATION

RFI No.:

To: **Darden Architects**
6790 N. West Ave
Fresno, California 93711

Date:

Respond By:

Attn:

Architect Project No.

DSA/HCAI Review Required **Yes** ☐ **No** ☐ **Apprd** ☐

Project:

INFORMATION REQUESTED:

Cost Impact: _____ Signature: _____

Schedule Impact: _____ Days Pages Attached: _____

Trade/Contractor: Schedule Task No/Item:

The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in the Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgement that there will be no change in the Contract Sum or Contract Time.

If the Contractor considers that this supplemental instruction requires a change in the Contract Sum or Contract Time, the Contractor shall not proceed with this Work and shall promptly submit an itemized proposal to the Architect for doing this work. If your proposal is found to be satisfactory and in order, this supplemental instruction will be superseded by a Construction Change Directive.

Refered To: Refered Date: Return Date:

SUPPLEMENTAL INSTRUCTIONS:

Consultant : _____ Architect _____

Date: _____ Date _____

Copy: ☐ Owner ☐ Inspector ☐ Testing Lab ☐ Structural ☐ Mech. ☐ Elec ☐ File ☐ Other Pages Attached: _____

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Fresno, California 93711
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Fax: 559.446.1765
www.dardenarchitects.com

SUPPLEMENTAL INSTRUCTIONS

PROJECT:

SUPPL. INST. NO.:

DATE OF ISSUANCE:

OWNER:

CONTRACT DATE:

NOTICE TO PROCEED:

CONTRACTOR:

Architect Project No.:
DSA Appl. No.:
DSA File No.:
OPSC Appl. No.:
HCAI No.:

The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in the Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgement that there will be no change in the Contract Sum or Contract Time.

If the Contractor considers that this supplemental instruction requires a change in the Contract Sum or Contract Time, the Contractor shall not proceed with this Work and shall promptly submit an itemized proposal to the Architect for doing this work. If your proposal is found to be satisfactory and in order, this supplemental instruction will be superceded by a Construction Change Directive.

Description:

Trade/Contractor:

Schedule Task No/Item:

Attachments:

Darden Architects, Inc.

Issued By:

Architect

☐ **OWNER** ☐ **CONTRACTOR** ☐ **INSPECTOR** ☐ **TESTING LAB** ☐ **STRUCTURAL** ☐ **MECHANICAL** ☐ **ELECTRICAL** ☐ **OTHER**

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Fax: 559.446.1765
www.dardenarchitects.com

REQUEST FOR PROPOSAL

PROJECT:

REQUEST FOR PROPOSAL NO.:

DATE OF ISSUANCE:

OWNER:

CONTRACT DATE:

NOTICE TO PROCEED:

CONTRACTOR:

Architect Project No.:
DSA Appl. No.:
DSA File No.:
OPSC Appl. No.:
HCAI No.:

Please submit an itemized proposal for change in the Contract Sum and Contract Time for proposed modifications to the Contract Documents described herein. Submit proposal promptly or notify the Architect in writing of the date on which you anticipate submitting your proposal.

This is not a Change Order, Construction Change Directive, or a direction to proceed with the Work described in the proposed modifications.

Description:

Attachments

Darden Architects, Inc.

ISSUED BY:

Architect

☐ **OWNER** ☐ **CONTRACTOR** ☐ **ARCHITECT** ☐ **CONSULTANT** ☐ **INSPECTOR** ☐ **OTHER**

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CONSTRUCTION CHANGE DIRECTIVE

PROJECT:

DIRECTIVE NO.:

DATE OF ISSUANCE:

OWNER:

CONTRACT DATE:

NOTICE TO PROCEED:

CONTRACTOR:

Architect Project No.:
DSA Appl. No.:
DSA File No.:
OPSC Appl. No.:
HCAI No.:

You are hereby directed to make the following change(s) in this Contract:

CONTRACT ADJUSTMENT

1. The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:

- ☐ Lump Sum
- ☐ Unit Price of
- ☐ As provided for in General Conditions and the Supplemental Conditions of the contract.
- ☐ As Follows:

2. The Contract Time is proposed to (be adjusted) . The proposed adjustment, if any, is increase of _____ days)

When signed by the Owner and Architect and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the change(s) described above.

Signature by the Contractor indicates the Contractor's agreement with the proposed adjustments in Contract Sum and Contract Time set forth in this Construction Change Directive.

ARCHITECT	OWNER	CONTRACTOR
Darden Architects		
6790 N. West Ave		
Fresno, California 93711		
By:	By:	By:
Date:	Date:	Date:

☐ **OWNER** ☐ **CONTRACTOR** ☐ **ARCHITECT** ☐ **CONSULTANT** ☐ **INSPECTOR** ☐ **OTHER**

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6790 N. West Ave
Fresno, California 93711
Tel: 559.448.8051
Fax: 559.446.1765
www.dardenarchitects.com

CHANGE ORDER REQUEST REVIEW

PROJECT:

CHANGE ORDER REQUEST NO.:

DATE OF ISSUANCE:

OWNER:

CONTRACTOR:

Architect Project No.:
DSA Appl. No.:
DSA File No.:
OPSC Appl. No.:
HCAI No.:

DESCRIPTION OF PROPOSED CHANGE:

Requested By:

Scope:

Necessary for:

DESIGN CONSULTANT'S REVIEW:

Date Sent:
Referred To:
Date Returned:

ACTION:

- ☐ NO EXCEPTION TAKEN RELATIVE TO COST
- ☐ NO EXCEPTION TAKEN RELATIVE TO TIME
- ☐ AMEND AS NOTED AND RESUBMIT
- ☐ REJECTED

Consultants Remarks

ARCHITECT'S REVIEW:

Date Returned:

ACTION:

- ☐ NO EXCEPTION TAKEN RELATIVE TO COST
- ☐ NO EXCEPTION TAKEN RELATIVE TO TIME
- ☐ AMEND AS NOTED AND RESUBMIT
- ☐ REJECTED

Architects Remarks:

Attachments:

REVIEWED:

Darden Architects
6790 N. West Ave
Fresno, California 93711

APPROVED:

Darden Architects : **Date :**

Owner : **Date :**

The Architect is hereby directed to instruct the Contractor to make the above changes in the Project and to include these changes in a subsequent Change Order:

☐ **OWNER** ☐ **CONTRACTOR** ☐ **INSPECTOR** ☐ **STRUCTURAL** ☐ **MECHANICAL** ☐ **ELECTRICAL** ☐ **OTHER**

CHANGE ORDER REQUEST NO.

Project Architect's Project No.:

CHANGE ORDER REQUEST- BREAKDOWN WORKSHEET

WORK DELETED:

Contractor				
Materials	$0.00			
Equipment	$0.00			
Labor	$0.00			
Material, Equipment, & Labor		$0.00		
TOTAL:				**$0.00**

ADDITIONAL WORK PERFORMED BY SUB-CONTRACTOR

Sub-Contractor				
Materials	$0.00			
Equipment	$0.00			
Labor	$0.00			
Material, Equipment, & Labor		$0.00		
Overhead		$0.00		
Profit		$0.00		
Sub Total:			$0.00	
Contractor				
Overhead			$0.00	
Profit			$0.00	
TOTAL:				**$0.00**

ADDITIONAL WORK PERFORMED BY CONTRACTOR

Contractor				
Materials	$0.00			
Equipment	$0.00			
Labor	$0.00			
Material, Equipment, & Labor		$0.00		
Overhead		$0.00		
Profit		$0.00		
TOTAL:				**$0.00**

TOTAL COST: $0.00

TOTAL COST:	$0.00
TOTAL DAYS:	0

ARCHITECTURAL ADMINISTRATIVE FEES:

Proposal Request Administration	$0.00
Construction Administration	$0.00
TOTAL:	$0.00
DSA Fees:	$0.00

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Tel: 559.448.8051
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www.dardenarchitects.com

CHANGE ORDER

PROJECT:

CHANGE ORDER NO.:

DATE OF ISSUANCE:

OWNER:

CONTRACT DATE:

NOTICE TO PROCEED:

CONTRACTOR:

Architect Project No.:
DSA Appl. No.:
DSA File No.:
OPSC Appl. No.:
HCAI No.:

The Contract is changed as follows:

Description:

It is mutually agreed that the affixed signature to this Change Order is evidence that all compensation with respects to the changes defined herein have been satisfied with the execution of this document. Furthermore, no additional compensation either monetarily or via time extension to this contract will be sought in respect to this Change Order.

The Original Contract Sum and Contract Completion Date:		
Net change (Contract Sum and Contract Time) by previous Change Orders:		days
Contract Sum and Contract Completion Date prior to this Change Order:		
Contract Sum and Contract Time (increased or decreased) by this Change Order:		days
New Contract Sum and Contract Completion Date including this Change Order:		

CONTRACTOR	ARCHITECT	OWNER
	Darden Architects	
	6790 N. West Ave	
	Fresno, California 93711	
By:	By:	By:
Date:	Date:	Date:

☐ OWNER ☐ CONTRACTOR ☐ ARCHITECT ☐ CONSULTANT ☐ INSPECTOR ☐ OTHER

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FRAGNET SUBMITTAL FORM

Date: _____ Sheet _____ of _____

From: _____ Fragnet No.: _____

To: Darden Architects, Inc.

Description of Delay: By reference to attached schedule fragnet, the following delay occurred:

_____

_____

_____

Continued on Sheets _____ of _____

Time Extension Requested: _____ wds, _____ cds.

Time Requested for Activity: Time Requested for Project:

Related Documents: The following construction documents provide evidence of the delay event:

RFI Nos.: _____ SI Nos.: _____

CCD Nos: _____ RFP Nos.: _____

Daily Reports Dated: _____ and attached.

Project Correspondence Dated: _____ and attached.

Other Documentation: _____

Schedule-Related Information: By reference to the attached fragnet, provide the following:

Predecessor Activity to Fragnet:

Successor Activity to Fragnet:

Affected CPM Schedule Activities (list IDs and descriptions):

_____

_____

New CPM Schedule Activities (list IDs and descriptions):

_____

_____

END OF FORM

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APPLICATION FOR PAYMENT

To:
DARDEN ARCHITECTS, INC.
6790 N. West Avenue
Fresno, CA 93711

Project: _____

Bid Package No. _____

FROM _____
Prime Contractor

Address: _____

Phone: _____

Pay Application No.: _____

Application Date: _____

Period Ending: _____

Distribution to:
Owner: _____
Architect: _____
Contractor: _____
Const Mgr.: _____
Inspector: _____

CONTRACTOR'S APPLICATION FOR PAYMENT

CHANGE ORDER SUMMARY		
APPROVED CHANGE ORDERS:		
Change Order No.:	Approved Date:	Amount:
		$
		$
		$
		$
		$
		$
		$
		$
TOTALS		
Net change by Change Order		$

The undersigned Contractor certifies that in the best of his knowledge, information, and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the contractor for work for which previous Certificates for Payment were issued and payment received from the Owner and that current payment show herein is now due.

Contractor:

_____ **DATE:** _____

The present status of the account for this Contract is as follows:

ORIGINAL CONTRACT SUM	$
Net Change by Change Orders	$
CONTRACT SUM TO DATE:	$
TOTAL COMPLETE & STORED TO DATE:	$
RETAINAGE:_____%:	$
TOTAL EARNED LESS RETAINAGE:	$
LESS STOP NOTICE(S):	$
LESS PREVIOUS PAYMENT:	$
CURRENT PAYMENT DUE:	$

This Certificate is not negotiable. This AMOUNT CERTIFIED is payable only to the Contractor named herein, issuance, payment and acceptance of payment, are without prejudice to any rights of the Owner or Contractor under this contract.

CONTRACTOR: _____ DATE: _____

CONSTRUCTION MANAGER: _____ DATE: _____

INSPECTOR: _____ DATE: _____

ARCHITECT: _____ DATE: _____

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CONTRACTOR'S TESTING / INSPECTION REQUEST FORM

PROJECT: _____

DATE RECEIVED: _____ (by Inspector)

TIME RECEIVED: _____ (by Inspector)

BUILDING: _____

SITE/OFFSITE: _____

CONSTRUCTION PHASE (1, 2, 3, etc.): _____

SPECIFICATION SECTION (No.): _____

PLAN SHEET AND DETAIL: _____

SCOPE OF WORK: _____

(concrete, electrical, etc.)

INSPECTION REQUESTED BY: _____

(contractor name)

LOCATION (bldg., room, floor, wall, ceiling, etc.) _____

_____

_____

TYPE OF INSPECTION (concrete, framing, welding, masonry, electrical, etc.) _____

_____

_____

INSPECTION REQUESTED ON: _____ at _____ am/pm

(date) (time)

Note 1: A Minimum Notice of 48 hours is Required to be Received by the Inspection Officer Prior to the Time the Testing / Inspection is Requested to Begin.

_____

PRINT NAME AND TITLE OF PERSON REQUESTING INSPECTION

_____

SIGNATURE OF PERSON REQUESTING INSPECTION

Note 2: Contractor Must Accompany Inspector on Inspection, if Requested.

PASSED: _____ FAILED: _____

Note 3: See Attached Sheet for Explanation if Inspection Failed. Re-inspection Required.

INSPECTOR SIGNATURE: _____ Date: _____

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CONTRACTOR'S "DEVIATION NOTICE" INSPECTION REQUEST FORM

PROJECT: _____

DATE RECEIVED: _____ (by Inspector)

TIME RECEIVED: _____ (by Inspector)

DEVIATION NOTICE(S) (No.): _____

BUILDING: _____

SITE/OFFSITE: _____

CONSTRUCTION PHASE (1, 2, 3, etc.): _____

SPECIFICATION SECTION (No.): _____

SCOPE OF WORK: _____

(concrete, electrical, etc.)

INSPECTION REQUESTED BY: _____

(contractor company name)

LOCATION(S) OF WORK FOR INSPECTION (be specific- bldg.(s), room(s), etc.)

_____

_____

INSPECTION REQUESTED ON: _____ at _____ am/pm

(date) (time)

Note 1: A Minimum Notice of 48 hours is Required to be Received by the Inspection Officer Prior to the Time the "Deviation Notice" Inspection is Requested to Begin.

_____

PRINT NAME OF PERSON REQUESTING DEVIATION NOTICE INSPECTION

_____

SIGNATURE OF PERSON REQUESTING DEVIATION NOTICE INSPECTION

Note 2: Contractor Must Accompany Project Inspector on "Deviation Notice" Inspection, if Requested.

Note 3: See Attached "Deviation Notice" for Inspector's Comments and/or Date Completed.

PASSED: _____ FAILED: _____

PROJECT INSPECTOR SIGNATURE: _____

DATE: _____

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CONTRACTOR'S FINAL INSPECTION REQUEST FORM

PROJECT: _____

DATE RECEIVED: _____ (by Inspector)

TIME RECEIVED: _____ (by Inspector)

BUILDING: _____

SITE/OFFSITE: _____

CONSTRUCTION PHASE (1, 2, 3, etc.): _____

SPECIFICATION SECTION (No.): _____

SCOPE OF WORK: _____

(concrete, electrical, etc.)

INSPECTION REQUESTED BY: _____

(contractor company name)

INSPECTION REQUESTED ON: _____ at _____ am/pm

(date) (time)

Note 1: A Minimum Notice of 48 hours is Required to be Received by the Inspection Officer Prior to the Time the Final Inspection is Requested to Begin. Contractor to be Notified by the Construction Manager in Regards to the Actual Date and Time of the Final Inspection.

_____

PRINT NAME AND TITLE OF PERSON REQUESTING FINAL INSPECTION

_____

SIGNATURE OF PERSON REQUESTING FINAL INSPECTION

Note 2: Contractor Must Accompany Project Inspector, Architect and/or Engineer(s) on Final Inspection, if Requested.

PASSED: _____ FAILED: _____

Note 3: If the Final Inspection Fails Re-Inspection is Required. See Attached Sheet for Comment(s).

PROJECT INSPECTOR SIGNATURE: _____

DATE: _____

PROJECT ARCHITECT SIGNATURE: _____

DATE: _____

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CONTRACTOR'S PUNCHLIST INSPECTION REQUEST FORM

PROJECT: _____

DATE RECEIVED: _____ (by Inspector)

TIME RECEIVED: _____ (by Inspector)

BUILDING: _____

SITE/OFFSITE: _____

CONSTRUCTION PHASE (1, 2, 3, etc.): _____

SPECIFICATION SECTION (No.): _____

SCOPE OF WORK: _____

(concrete, electrical, etc.)

INSPECTION REQUESTED BY: _____

(contractor company name)

LOCATION(S) OF WORK FOR INSPECTION: (be specific- bldg.(s), room(s), etc.)

_____

_____

DESCRIPTION OF WORK TO BE INSPECTED: (item number(s) from punchlist)

_____

_____

INSPECTION REQUESTED ON: _____ at _____ am/pm

(date) (time)

Note 1: A Minimum Notice of 48 hours is Required to be Received by the Inspection Officer Prior to the Time the Punchlist Inspection is Requested to Begin.

_____

PRINT NAME OF PERSON REQUESTING PUNCHLIST INSPECTION

_____

SIGNATURE OF PERSON REQUESTING PUNCHLIST INSPECTION

Note 2: Contractor Must Accompany Project Inspector on Punchlist Inspection, if Requested. Items Must Have Already Been Signed Off by Contractor.

Note 3: Attached Sheet for Contractor's Signoff and/or Inspector's Comments and/or Date Completed for the Specific Punchlist Items Noted Above.

Note 4: This Inspection is NOT A FINAL INSPECTION but Only an Acknowledgement That a Particular Item(s) is/are completed.

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PROJECT: _____ - CONTRACTOR'S PUNCHLIST

CONTRACTOR NAME: _____ Page _____ of _____

ITEM NO.	DESCRIPTION	BUILDING & ROOM NO.	FLOOR	CEILING	WALLS N. S. E. W.	DATE OBSERVED	SIGNOFF/ COMMENTS

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SECTION 01 33 00 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely provide all required submittals and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 SUBMITTALS

A. Contractor's responsibilities:
   1. The Contractor shall check, verify, and be responsible for all field measurements.
   2. The Contractor shall submit a schedule indicating when the required shop drawings and submittals will be submitted to the Architect.
      a. Submit schedule within the amount of days as indicated in Specification Section - CONSTRUCTION SCHEDULES.
   3. Submit copies as scheduled below, checked and approved by the Contractor for all submittals required for the work of the various trades. Deliver submittals promptly to avoid delays in delivery of materials or execution of the work.
      a. The Contractor (or Subcontractor) shall mark-up the submittals as to project specifics. If the specifications contains a schedule prepared by the Architect (i.e. paint symbols such as DW-1, M-1, CB-1, etc., or tile symbols such as CT-1,CT-2, or IWA, IWB, IWC, etc.), then the submittal will also contain those designations. Submittals without project specifics will be returned to the Contractor as not being properly prepared.
      b. The Contractor shall stamp the Submittals utilizing any language requested by the Owner in the General Conditions and the following minimum language:

"This submittal has been reviewed by (Name of Contractor) and approved with respect to the means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incidental thereto. The Contractor has reviewed and approved not only the field dimensions, but the construction criteria, and has also made written notation regarding any information in the Shop Drawings that does not conform to the Contract Documents. The Contractor has reviewed this submittal and coordinated with all other Shop Drawings received to date by the Contractor and this duty of coordination has not been delegated to subcontractors, material suppliers, the Architect, or the design consultants on this project. The Contractor shall also have indicated that it has not relied upon the dimensions shown on the drawings, specifications and schedules, and that the Contractor has double-checked all dimensions for accuracy and fit. (Name of Contractor) also warrants that this submittal complies with the Contract Documents and comprises no variation thereto."

By: _____Contractor's Signature

_____Contractor's Typed Name

Date: _____

c. Substitutions on shop drawings or in product submittals will not be considered without prior approval in accordance with Specification Section - SUBSTITUTION PROCEDURES. Submittals containing unacceptable items will be rejected.

d. The Contractor shall make any corrections required by the Architect during the Architect's initial review, and re-submit the required corrected copies for final review and distribution.

B. Architect's responsibilities:

1. The Architect will make any desired corrections with reasonable promptness, and return the submittal to the Contractor.

2. The Architect's review of such drawings or schedules shall not relieve the Contractor of responsibility for deviations from the drawings or specifications, unless he has, in writing, called the Architect's attention to such deviations at the time of submission, and secured written acceptance.

a. The Architect's review shall be for general conformance with the design concept for the project and general compliance with the information given in the Contract Documents.

b. The Architect's review shall not be construed as an "approval," or to relieve the Contractor(s) and material suppliers of responsibility for errors or omissions in the submitted documents.

c. Modifications or comments made on the submittals or shop drawings during this review do not relieve the Contractor from compliance with the requirements of the drawings and specifications.

d. Acceptance of a specific item does not include acceptance of the assembly of which the item is a component.

C. The following list of items, definitions and required quantities is a minimum required for this project. Verify with FACILITY SERVICES SUBGROUP sections for additional quantities required within those divisions.

1. Product Data: Illustrations, standard schedules, performance charts, instructions, brochures, diagrams, other product information, color choices and/or manufacturer's catalog sheets shall be specially prepared for the Project (marked-up with project specifics) and shall be submitted in sequential sets for each category of work:

a. Quantity:

1) Unless otherwise indicated in the Contract Documents, provide Six (6) sets.

b. Material Safety Data Sheets (MSDS): MSDS are not required, but it is recognized that applicable federal and state laws require the submission of these data sheets to an Owner. MSDS shall be turned over to the Owner (without review by the Architect or it's consultants) in compliance with federal and state laws.

2. Shop Drawings: Newly prepared information, drawn to accurate scale, consisting of drawings, diagrams, schedules, and other data specifically prepared for the Project by the Contractor, a Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Project. Do not reproduce Contract Documents or copy Standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

a. Quantity: Provide One (1) reproducible original (vellum, sepia or mylar) and Three (3) opaque (blue-line or black-line xerographic) prints for each sheet or detail.

1) The contractor shall receive the marked-up reproducibles and copy the required number of sets to the subcontractor, manufacturer's and/or material suppliers.

b. Contractor's use of Architect's Electronic CAD Files.

1) Upon written request by Contractor, copies of the Architect's electronic CAD files may be available for Contractor's use in connection with this Project.
   a) Contractor's written request shall be on the Architect's "Contractor's Document Usage Agreement for Requested Documents" and may include an additional Architect's Consultant's Agreements, outlining conditions for providing files.
   b) Contractor's request shall be limited to drawings directly applicable to the Shop Drawings the Contractor wishes to create for submittal.
   c) Contractor shall pay the Architect for work incurred for providing the requested files. Payment shall be submitted with the request.
2) The Architect's electronic CAD files are limited to files that already exist and that not all files may be available at the Architect's and Architect's Consultant's discretion.
3) The Architect's electronic CAD files are not part of the Contract Documents and have limitations to the accuracy, incorporating modifications, CAD system formats, CAD entity attributes and layering.
4) The Architect's electronic CAD files have restrictions on Contractor's use, transmittal and delivery of files.

3. Samples: Physical examples specially prepared for the Project (marked-up with project specifics) which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.
   a. Quantity:
      1) Unless otherwise indicated in the Contract Documents, provide Four (4) sets.
   b. Color samples shall be submitted on 8-1/2" x 11" cards for all colors scheduling paint types specified utilizing the paint symbols designated by the Architect in the drawings and specifications.
   c. Manufactured devices or equipment items:
      1) Quantity: One (1) sample, returned to supplier and which, when approved, may be incorporated into the Project.
4. Quality Assurance/Control submittals: Consists of design data, test reports, certificates, manufacturers instructions, and /or manufacturer's field reports.
   a. Quantity:
      1) Unless otherwise indicated in the Contract Documents, provide Six (6) sets.
5. Closeout submittals: Maintenance data, operating manuals, project documents, engineering calculations, and/or warranties shall be submitted when required in the various specification sections:
   a. Quantity:
      1) Unless otherwise indicated in the Contract Documents, provide Two (2) sets.
6. Field Samples: Sample panels of in place construction, or selected area of completed substrates or work showing the anticipated compliance with specified characteristics in order to establish a standard of quality.
   a. Quantity:
      1) See specific specification section requirements.
7. Mockups: Full-sized erected assemblies, used for coordination purposes or for testing in a laboratory, or required for approval in a finish form before the actual Project construction begins.
   a. Quantity:
      1) See specific specification section requirements.

D. Substitution, Dispute or Claim Submittals:

1. Any substitution, dispute or claim submittals relating to this contract, or any Contract breach, which are not disposed of by agreement shall be promptly submitted in accordance with the GENERAL CONDITIONS, as a claim to and decided by the Architect who shall issue a written decision on the dispute.
2. Adequate supporting data shall include, but is not limited; a statement of the reasons for the asserted entitlement, the certified payroll, invoice for material and equipment rental, and an itemized breakdown of any adjustment sought.
3. If no "SUBMISSION UNDER PENALTY OF PERJURY" clause is provided within the GENERAL CONDITIONS, then the Contractor shall certify, at the time of submission of a substitution, dispute or claim, as follows:

(The rest of this page is left intentionally blank)

SUBMISSION UNDER PENALTY OF PERJURY

I _____, being the _____(Must be an officer), declare under penalty of perjury under the laws of the State of California, and do personally certify and attest that: I have thoroughly reviewed the attached substitution, dispute or claim for additional compensation and/or extension of time, and know its contents, and said claim is made in good faith; the supporting data is truthful and accurate; that the amount required accurately reflects the contract adjustment for which the Contractor believes the Owner is liable; and further, that I am familiar with California Government Code Section 12650, et seq, pertaining to false claims, and further know and understand that submission of certification of a false claim may lead to fines, imprisonment and/or other severe legal consequences.

By: _____Contractor's Signature

_____Contractor's Typed Name

Date: _____

Submission of a substitution, dispute or claim, properly certified, with all required supporting documentation, and written rejection or denial or all or part of the claim by Owner, is a condition precedent to any action, proceeding, litigation, suit or demand for arbitration by Contractor.

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PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 SCHEDULES

A. The following schedule was prepared to assist the Contractor in knowing the required submittals for this project, but may not be complete. Specific submittal information as to what is required is contained within the individual specification sections and those individual sections shall govern in the event of a question.

B. SUBMITTAL SCHEDULE

1. 01 11 13 - SUMMARY OF WORK
   a. QUALITY ASSURANCE/ CONTROL SUBMITTALS
2. 01 25 00 - SUBSTITUTION PROCEDURES
   a. SUBSTITUTION REQUEST FORMS
3. 01 29 73 - SCHEDULE OF VALUES
   a. SCHEDULE OF VALUES
4. 01 32 16 - CONSTRUCTION SCHEDULES
   a. CONSTRUCTION SCHEDULE, SHOP DRAWING SUBMITTAL SCHEDULE, CRITICAL PATH SCHEDULES, FRAGNETS.
5. 01 32 26 - FORMS AND REPORTS
   a. AS REQUIRED BY THIS SPECIFICATION SECTION AND OTHER SPECIFICATION SECTIONS.
6. 01 33 00 - SUBMITTAL PROCEDURES
   a. SHOP DRAWING AND SUBMITTAL SCHEDULE, COLOR SAMPLES OF ALL FINISH MATERIALS FOR COLOR BOARD SELECTION.
7. 01 45 29 - TESTING LABORATORY SERVICES
   a. TESTING SCHEDULE, TEST REPORTS
8. 01 71 23 - FIELD ENGINEERING
   a. COORDINATION DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS.
9. 01 77 20 - PROJECT CLOSEOUT
   a. ANOTATED CONTRACTOR’S AND ARCHITECT’S PUNCH LIST. ALL OPERATIONAL DATA, ALL MAINTENANCE MANUALS, ALL EXTRA MATERIALS.
10. 01 78 36 - WARRANTIES
    a. ALL GUARANTEES AND WARRANTIES
11. 01 78 39 - PROJECT DOCUMENTS
    a. PROJECT "AS-BUILT" DOCUMENTS, PROJECT "RECORD" DOCUMENTS AND PROJECT "CERTIFICATION" DOCUMENTS.
12. 03 11 01 - CONCRETE FORMWORK
    a. PRODUCT DATA, SAMPLES, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS.
13. 03 15 14 - DRILLED ANCHORS
    a. PRODUCT DATA, ICC EVALUATION SERVICE REPORTS, DSA APPROVAL LETTERS.
14. 03 20 00 - REINFORCEMENT
    a. SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS.
15. 03 30 00 - CAST-IN-PLACE CONCRETE

a. PRODUCT DATA, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS.

16. 03 35 10 - POLISHED CONCRETE FINISHING
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/ CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS.
17. 03 52 13 - INSULATING CONCRETE
    a. PRODUCT DATA, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS.
18. 04 21 13 - THIN BRICK VENEER
    a. SAMPLES, COLOR SAMPLES, PRODUCT DATA CERTIFICATION.
19. 04 22 00 - CONCRETE MASONRY UNITS
    a. SAMPLES, COLOR SAMPLES, PRODUCT DATA CERTIFICATION.
20. 04 23 00 - GLASS MASONRY UNITS
    a. SAMPLES, COLOR SAMPLES, PRODUCT DATA CERTIFICATION.
21. 05 12 00 - STEEL AND FABRICATIONS
    a. PRODUCT DATA, SHOP DRAWINGS, SAMPLES, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS.
22. 05 30 00 - METAL DECK
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS.
23. 05 52 00 - RAILING SYSTEMS
    a. MATERIALS LIST, SHOP DRAWINGS, AND WARRANTIES.
24. 06 10 00 - ROUGH CARPENTRY
    a. PRODUCT DATA, CERTIFIACTES OF COMPLIANCE, AND WARRANTIES.
25. 06 18 00 - GLUE-LAMINATED CONSTRUCTION
    a. SHOP DRAWINGS, VERIFIED REPORTS, AND WARRANTIES.
26. 06 22 00 - MILLWORK
    a. PRODUCT DATA, SHOP DRAWINGS, AND WARRANTIES.
27. 06 41 23 - MODULAR CASEWORK
    a. SHOP DRAWINGS, MANUFACTURER'S SPECIFICATIONS, COLOR SAMPLES, MOCK-UP, WI CERTIFICATION.
28. 06 61 16 - SOLID SURFACING
    a. SHOP DRAWINGS, MANUFACTURER'S SPECIFICATIONS, COLOR SAMPLES, MOCK-UP, WI CERTIFICATION.
29. 07 14 16 - FLUID-APPLIED WATERPROOFING
    a. PRODUCT DATA, INSTALLATION INSTRUCTIONS, CLOSEOUT SUBMITTALS.
30. 07 18 50 - VAPOR-ALKALINITY CONTROL
    a. PRODUCT DATA, INSTALLATION INSTRUCTIONS, CLOSEOUT SUBMITTALS.
31. 07 21 00 - INSULATION
    a. PRODUCT DATA, INSTALLATION INSTRUCTIONS, CLOSEOUT SUBMITTALS.
32. 07 31 13 - SHINGLES
    a. PRODUCT DATA, SHOP DRAWINGS, SAMPLES, CLOSOUT SUBMITTALS.
33. 07 40 00 - METAL PANELS
    a. PRODUCT DATA, SHOP DRAWINGS, SAMPLES, CLOSOUT SUBMITTALS.
34. 07 40 12 - MCM PANELS
    a. PRODUCT DATA, SHOP DRAWINGS, SAMPLES, CLOSEOUT SUBMITTALS.
35. 07 42 43 - FIBER-CEMENT PANELS
    a. PRODUCT DATA, SHOP DRAWINGS, SAMPLES, CLOSEOUT SUBMITTALS.

36. 07 51 13 - BUILT-UP ROOFING
    a. PRODUCT DATA, SHOP DRAWINGS AND WARRANTIES.
37. 07 53 16 - ELASTOMERIC MEMBRANE ROOFING
    a. PRODUCT DATA, SHOP DRAWINGS AND WARRANTIES.
38. 07 53 29 - ELASTOMERIC MEMBRANE ROOFING
    a. PRODUCT DATA, SHOP DRAWINGS AND WARRANTIES.
39. 07 60 00 - SHEET METAL
    a. SHOP DRAWINGS
40. 07 72 00 - ROOF ACCESSORIES
    a. PRODUCT DATA, SHOP DRAWINGS, SAMPLES AND WARRANTIES.
41. 07 81 16 - FIREPROOFING
    a. MATERIALS LIST, COLORS, MANUFACTURER'S DATA, TEST DATA AND SAMPLES.
42. 07 84 00 - FIRESTOPPING
    a. PRODUCT DATA, CERTIFICATIONS, SHOP DRAWINGS QUALIFICATION DATA ON INSTALLERS.
43. 07 92 00 - SEALANTS
    a. PRODUCT DATA, COLORS AND WARRANTIES.
44. 07 95 00 - EXPANSION JOINTS
    a. MATERIALS LIST, SHOP DRAWINGS, AND WARRANTIES.
45. 08 11 00 - METAL DOORS AND FRAMES
    a. PRODUCT DATA AND SHOP DRAWINGS.
46. 08 14 16 - WOOD DOORS
    a. PRODUCT DATA AND SHOP DRAWINGS.
47. 08 15 13 - LAMINATE-FACED WOOD DOORS
    a. PRODUCT DATA AND SHOP DRAWINGS.
48. 08 33 00 - COILING DOORS
    a. PRODUCT DATA, SHOP DRAWINGS AND WARRANTIES.
49. 08 34 73 - ACOUSTICAL DOORS AND FRAMES
    a. PRODUCT DATA, SHOP DRAWINGS AND WARRANTIES.
50. 08 41 00 - STOREFRONTS
    a. PRODUCT DATA, SHOP DRAWINGS AND WARRANTIES.
51. 08 51 13 - ALUMINUM WINDOWS
    a. PRODUCT DATA, SHOP DRAWINGS AND WARRANTIES.
52. 08 56 59 - SERVICE WINDOWS
    a. PRODUCT DATA, SHOP DRAWINGS AND WARRANTIES.
53. 08 63 00 - SKYLIGHTS
    a. PRODUCT DATA, SHOP DRAWINGS AND WARRANTIES.
54. 08 70 00 - HARDWARE
    a. HARDWARE SCHEDULE AND CERTIFICATES.
55. 08 80 00 - GLASS
    a. PRODUCT DATA, MATERIALS LIST, SAMPLES AND CERTIFICATES.
56. 08 91 00 - LOUVERS
    a. PRODUCT DATA, SHOP DRAWINGS, CERTIFICATES AND COLORS.
57. 09 22 16 - METAL FRAMING
    a. PRODUCT DATA (INCLUDING INSTALLATION METHODS) AND MATERIALS LIST.
58. 09 24 00 - CEMENT PLASTER
    a. PRODUCT DATA (INCLUDING INSTALLATION METHODS) AND MATERIALS LIST.
59. 09 26 13 - VENEER PLASTER

a. PRODUCT DATA (INCLUDING INSTALLATION METHODS) AND MATERIALS LIST.

60. 09 29 00 - GYPSUM BOARD
    a. PRODUCT DATA, FASTENING SCHEDULE AND SAMPLES.
61. 09 30 00 - TILE
    a. PRODUCT DATA, COLORS, SAMPLES, CERTIFICATES, MAINTENANCE MATERIAL AND WARRANTIES.
62. 09 51 00 - ACOUSTICAL CEILINGS
    a. ACOUSTICAL TILE SAMPLES, SUSPENSION SYSTEM SAMPLES AND DSA APPROVED CEILING BRACING DRAWINGS.
63. 09 64 29 - HARDWOOD FLOOR
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
64. 09 64 66 - RESILIENT WOOD FLOOR
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
65. 09 65 10 - RESILIENT BASE AND ACCESSORIES
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
66. 09 65 16 - RESILIENT SHEET
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
67. 09 65 19 - RESILIENT TILE
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
68. 09 67 23 - RESINOUS FLOORING
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
69. 09 68 40 - CARPET
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
70. 09 72 00 - WALL COVERINGS
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
71. 09 91 00 - PAINTING
    a. PRODUCT DATA, MATERIALS LIST, COLORS, MAINTENANCE INFORMATION AND WARRANTIES.
72. 10 05 00 - MISCELLANEOUS SPECIALTIES
    a. PRODUCT DATA, COLORS AND SAMPLES (WHERE APPLICABLE) FOR ALL ITEMS.
73. 10 11 00 - VISUAL DISPLAY BOARDS
    a. PRODUCT DATA AND SAMPLE COLORS.
74. 10 13 00 - DIRECTORIES
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
75. 10 14 00 - IDENTIFYING DEVICES
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
76. 10 14 53 - ROAD AND PARKING SIGNAGE
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
77. 10 21 13 - TOILET PARTITIONS
    a. PRODUCT DATA, SHOP DRAWINGS, CERTIFICATES AND COLORS.

78. 10 26 00 - WALL AND CORNER GUARDS
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
79. 10 28 13 - TOILET ACCESSORIES
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
80. 10 44 00 - FIRE PROTECTION SPECIALTIES
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
81. 10 51 13 - METAL LOCKERS
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
82. 10 56 13 - METAL STORAGE SHELVING
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
83. 11 16 16 - SAFES
    a. PRODUCT DATA, SHOP DRAWINGS, CERTIFICATES AND COLORS.
84. 11 40 00 - FOOD SERVICE EQUIPMENT
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
85. 11 53 00 - LAB CASEWORK AND EQUIPMENT
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
86. 11 66 00 - ATHLETIC EQUIPMENT
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
87. 11 66 43 - SCOREBOARDS
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
88. 11 68 00 - PLAYFIELD EQUIPMENT
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
89. 12 21 00 - BLINDS
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
90. 12 61 00 - FIXED SEATING
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
91. 12 66 13 - TELESCOPING BLEACHERS
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
92. 12 66 23 - TELESCOPING CHAIR PLATFORMS
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
93. 13 34 23 - CUSTOM PORTABLE BUILDINGS
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
94. 13 49 00 - RADIATION PROTECTION
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
95. 14 24 23 - HYDRAULIC ELEVATORS
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.

96. 14 42 00 - WHEELCHAIR LIFTS
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
97. 14 45 00 - VEHICLE LIFTS
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, CLOSEOUT SUBMITTALS AND WARRANTIES.
98. DIV 21 - FIRE SUPPRESSION SECTIONS
    a. REFER TO APPROPRIATE SPECIFICATION SECTION REQUIREMENTS.
99. DIV. 22 - PLUMBING SECTIONS
    a. REFER TO APPROPRIATE SPECIFICATION SECTION REQUIREMENTS.
100. DIV. 23 -HEATING, VENTILATING AND AIR CONDITIONING SECTIONS
    a. REFER TO APPROPRIATE SPECIFICATION SECTION REQUIREMENTS.
101. DIV. 25- INTEGRATED AUTOMATION SECTIONS
    a. REFER TO APPROPRIATE SPECIFICATION SECTION REQUIREMENTS.
102. DIV. 26- ELECTRICAL SECTIONS
    a. REFER TO APPROPRIATE SPECIFICATION SECTION REQUIREMENTS.
103. DIV. 27 -COMMUNICATIONS SECTIONS
    a. REFER TO APPROPRIATE SPECIFICATION SECTION REQUIREMENTS.
104. DIV. 28- ELECTRONIC SAFETY AND SECURITY SECTIONS
    a. REFER TO APPROPRIATE SPECIFICATION SECTION REQUIREMENTS.
105. 31 20 00 - EARTHWORK
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, PROJECT RECORD DOCUMENTS, AND WARRANTIES, AND DRAWINGS SHOWING KNOWLEDGE OF THE EXTENT OF ENGINEERED PADS.
106. 31 31 00- SOIL TREATMENT
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, PROJECT RECORD DOCUMENTS, AND WARRANTIES.
107. 32 12 00- PAVEMENT
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, PROJECT RECORD DOCUMENTS, AND WARRANTIES.
108. 32 80 00- LANDSCAPE IRRIGATION
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, PROJECT RECORD DOCUMENTS, AND WARRANTIES.
109. 33 40 00- STORM DRAINAGE
    a. PRODUCT DATA, SHOP DRAWINGS, QUALITY ASSURANCE/CONTROL SUBMITTALS, PROJECT RECORD DOCUMENTS, AND WARRANTIES.

END OF SECTION

SECTION 01 41 00 – REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
   2. Section 4-317 (c), Part 1, Title 24, CCR, requires the following:
      a. "The intent of these drawings and specifications is that the work of the alteration, rehabilitation or reconstruction is to be in accordance with Title 24, California Code of Regulations. Should any existing conditions such as deterioration of non-complying construction be discovered which is not covered by DSA approved documents wherein the finished work will not comply with Title 24, California Code of Regulations, a construction change document, or a separate set of plans and specifications, detailing and specifying the required repair work shall be submitted to and approved by DSA before proceeding with the repair work."

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 REFERENCES

C. References to standards, codes, specifications, recommendations and regulations, refer to the latest edition or printing in effect at the date of issue shown in the Documents unless another date is implied by the suffix number of the Standards.

D. Applicable portions of the Standards listed that are not in conflict with the Contract Documents shall be construed as specification for this work.

E. General Standards:
   1. AFPA American Forest and Paper Association
   2. ANSI American National Standards Institute
   3. ASTM American Society for Testing and Materials
   4. CAL/OSHA California Occupational Safety and Health Administration
      a. State of California Construction Safety Orders
   5. CARB California Air Resources Board
   6. CS Commercial Standards of the US Department of Commerce
   7. EPA Environmental Protection Agency
   8. FMG Factory Mutual Group
   9. NIBS National Institute of Building Sciences
   10. NIST National Institute of Standards and Technology
   11. NFPA National Fire Protection Association
   12. OSHA Occupational Safety and Health Administration
      a. Federal Construction Safety Orders
   13. PS Product Standards of the US Department of Commerce
   14. SS-CDOT "Standard Specification":
      a. State of California Department of Transportation (CalTrans)

15. UL Underwriters Laboratory Incorporated
16. WH Warnock Hersey

1.3 SUBMITTALS

17. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
18. Quality Assurance/Control Submittals:
    a. Certificates:
        1) Submit three (3) copies of certificates written on the Contractor's Letterhead indicating that the required codes shall be present at the Job Site.

1.4 QUALITY ASSURANCE

F. Regulatory Requirements:
1. All codes, laws, ordinances, rules, regulations, orders and other legal requirements of City, County, State, Federal and other public authorities which bear on performances of Work shall be applicable to Project. Latest editions shall be applicable unless specified otherwise.
2. Relationship between Applicable Codes and Contract Documents. The Contract Documents have been developed with the intent to conform to the applicable codes. Nothing within the Contract Documents shall be construed to permit Work not conforming to the applicable codes.

G. Major Governing Codes And Regulations:
1. General: All work shall comply with the requirements of the following codes and regulations. Special reference in other Sections of the Specifications to a specific code will be by use of the abbreviation given in front of the Code.
    a. Freestanding equipment (if applicable) shall be provided and installed in accordance with the seismic requirements where the Project is located.
2. NOTE: * -Indicates that a copy of these codes shall be at the job site at all times.
3. AUTHORITY HAVING JURISDICTION:
    a. AHJ: Authority Having Jurisdiction
4. FEDERAL LAW:
    a. ADA: Americans with Disabilities Act
5. CALIFORNIA CODE OF REGULATIONS (Previously known as the California Administrative Codes)
    a. CCR-T5: California Code of Regulations, Title 5-Education.
    b. CCR-T8: California Code of Regulations, Title 8-Industrial Safety
        1) Contains the California Elevator Safety Code.
    c. CCR-T19: California Code of Regulations, Title 19-Public Safety.
    d. CCR-T21: California Code of Regulations, Title 21-Public Works.
    e. *CCR-T24: California Code of Regulations, Title 24, Part 1-California Administrative Code 2022.
6. CALIFORNIA BUILDING, ELECTRICAL, MECHANICAL, PLUMBING, ENERGY, FIRE, and REFERENCED CODES
    a. *CBC: California Building Code 2022 California Code of Regulations, Title 24-Part 2, Volumes 1 and 2, CCR-T24, based on the 2021 edition of the IBC (International Building Code), with the latest California State Amendments.
    b. *CEC: California Electrical Code 2022, California Code of Regulations, Title 24-Part 3, CCR-T24, based on the 2020 edition of the NEC (National Electrical Code), with the latest California State Amendments.
    c. *CMC: California Mechanical Code 2022, California Code of Regulations, Title 24, Part 4, CCR-T24, based on the 2021 edition of the UMC (Uniform Mechanical Code) by IAPMO, with the latest California State Amendments.

d. *CPC: California Plumbing Code 2022, California Code of Regulations, Title 24, Part 5, CCR-T24, based on the 2021 edition of the UPC (Uniform Plumbing Code) by IAPMO, with the latest California State Amendments.
e. *CEnC: California Energy Code 2022, California Code of Regulations, Title 24, Part 6, CCR-T24, and the latest California State Amendments.
f. *CFC: California Fire Code 2022, California Code of Regulations, Title 24, Part 9, CCR-T24, based on the 2021 edition of the IFC (International Fire Code), with the latest California State Amendments.
1) In addition to all other Chapters in the CFC to be followed, attention is specifically called out to comply with Chapter 33 - "Fire Safety During Construction and Demolition".
g. CEBC: California Existing Building Code 2022, California Code of Regulations, Title 24, Part 10, CCR-T24.
h. CGBSC: California Green Building Standards Code 2022, California Code of Regulations, Title 24-Part 11, CCR-T24 (CALGreen).
i. CRSC: California Referenced Standard Code 2022, Title 24, Part 12, CCR-T24, with the latest California State Amendments.

7. DSA: DIVISION OF THE STATE ARCHITECT:
a. DSA: Regulations of the Division of the State Architect of the State of California:
1) ACS: Access Compliance Section
2) SSS: Structural Safety Section
3) FLS: Fire and Life Safety Section
4) IR: Interpretation of Regulations.

8. OTHER STATE AGENCIES:
a. AQMCD: Air Quality Management Control District in the area where the project is located.
b. RWQCB: Regional Water Quality Control Board in the area where the project is located.

H. Governing Authority:
1. DSA: Division of the State Architect.
a. The provisions of the State of California, Statutes of 1933, Chapter 59, Safety of Construction of Public School Buildings Act, and the latest regulation based thereon, of the Division of the State Architect of the State of California, shall be the governing authority and shall take precedence over other applicable codes.
b. The following shall be stamped and signed by the A/E on Record or Delegated Design Professional per CBC, Part 1, Section 4-317 (h), and the following:
1) Addenda or Bulletins per Sec. 4-338(b): All addenda or bulletins shall be signed and approved by the Division of State Architect.
2) Construction Changes per Sec. 4-338(c): All Construction Changes related to structural items, fire safety issues, life safety issues and accessibility compliance issues shall be reviewed and approved by the appropriate Division of the State Architect.
3) Substitutions (per DSA) shall be treated like Addenda, or Construction Changes per Sec. 4-338(c), and IR A-6: All substitution requests and substitutions related to structural items, fire safety issues, life safety issues and accessibility compliance issues shall be reviewed and approved by the appropriate Division of the State Architect prior to fabrication and installation.

I. Merced County Health Department

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION

SECTION 01 42 00 – REFERENCES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
    a. The abbreviations, symbols and work meanings not defined in the Contract Documents are in accordance with building industry usage and convention. Questions which arise as to "meaning," or intent shall be referred to the Architect prior to bidding for interpretation.
    b. Refer to drawings for additional abbreviations and symbols.
    c. Refer to GENERAL and SPECIAL or SUPPLEMENTAL CONDITIONS and specific specification Sections for additional definitions.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 DEFINITIONS

A. EXECUTE Perform what is required to install, apply, erect and otherwise incorporate products in to this Project.

B. FURNISH Supply products required, deliver to Project, unload, store and install as required in location as directed by Contractor, Owner or Architect.

C. GUARANTEE An assurance by the seller or installer that products or Work are as represented or will be as promised in compliance with Specifications. Synonymous and interchangeable with WARRANTY.

D. INSTALL Incorporate into this Project.

E. PRODUCTS The material, equipment, fixtures and other physical substances required to execute the Project.

F. PROVIDE Furnish and Install into this Project.

G. WARRANTY An assurance by the seller or installer that products or Work are as represented or will be as promised in compliance with Specifications. Synonymous and interchangeable with GUARANTEE.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION

SECTION 01 45 23 – TESTING AND INSPECTION SERVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. One Project Inspector (Owner's Inspector), including Special and/or Assistant Inspector(s) (minimum Class 1 Rating), as required, will be employed by the Owner in accordance with the requirements of CCR-Title 24, Part 1, CALIFORNIA ADMINISTRATIVE CODE, and the latest amendments, and will be assigned to the Project.
      a. Duties of a Project Inspector are specifically defined in CCR-Title 24, Part 1, and the latest amendments.
      b. Special Inspections (not within the Project Inspector's abilities) shall be performed by the Testing Laboratory or other Special Inspector as approved by the Owner and DSA.
         1) All Special Inspections shall be approved by DSA in accordance with CCR-T24, Part 1, Chapter 4, Group 1, Article 5, Section 4-335.1.
   2. The Project Inspector shall be employed by the Owner and approved by the Architect, Structural Engineer, and DSA.
      a. See the Title Page of this Project Manual for the name of this Project.
      b. Payment of the Project Inspector will be by the Owner.
   3. Provide all access, facilities and information required by the Project Inspector for the Project.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 DEFINITIONS

A. Responsibilities of the Project Inspector:
   1. The Project Inspector will be required to provide inspection of the Work (including "Continuous Inspection") as required in CCR-T24, Part 1:
      a. Educational Work: Chapter 4, Group 1, Article 6, 4-342 (b).
   2. The Project Inspector will report to the Owner, the Architect and DSA as required during the progress of the Work.
   3. The Project Inspector shall review all Pay Requests prior to submittal to the Architect.

B. Responsibilities of the Contractor:
   1. Written Statement of Responsibility to the Owner and the Authority Having Jurisdiction (DSA) per CBC Chapter 17A:
      a. Provide a written Statement of Responsibility regarding the Contractor's understanding of the special inspection requirements and identifying individuals in their firm responsible for exercising control over the conformance to the construction documents.
   2. Provide the Project Inspector free access to any and all parts of the Project at all times.
   3. Provide the Project Inspector information necessary to keep him fully informed with respect to the progress, manner and character of Work.

4. Perform no Work in absence of the Project Inspector unless alternate arrangements have been made in advance and agreed to by the Owner, the Architect and DSA.
5. The Owner's "Inspection of Work" by the Project Inspector shall not relieve the Contractor from any conditions of this Contract.

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Quality Assurance/Control Submittals:
      a. Written Statement of Responsibility to the Owner and the Authority Having Jurisdiction per CBC Chapter 17A.
      b. Project Inspector's Field Reports:
         1) Submit four (4) copies of reports.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION

SECTION 01 45 29 – TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. The Owner's Testing Laboratory shall be employed by the Owner and approved by the Architect, Structural Engineer, and DSA.
      a. Payment of the Owner's Testing Laboratory will be by the Owner.
      b. The Owner shall pay for all initial testing indicated as paid for by Owner except as specified otherwise or in the schedule at the end of this section.
         1) Cost of re-testing (due to initial failures) shall be back-charged to the Contractor, and those excess costs will be deducted from the Contract Price.
         2) Cost of testing (due to shop fabrication or in-plant testing out of state and beyond a 75 mile radius of the Project Site) shall be back-charged to the Contractor, and those excess costs will be deducted from the Contract Price.
   2. Provide all access, facilities and information required for the testing of the various portions of the Work as required by Regulatory Agencies, Planning, Agencies, Building Agencies, and other Governmental Inspectors, the Contract Documents and the Owner.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 DEFINITIONS

A. Responsibility of the Testing Laboratory:
   1. Taking all specimens.
   2. Performing Tests.
      a. The Testing Laboratory's duties shall include all tests required by the DSA 103 Form prepared at the time of DSA Approvals, and any other testing as determined by authorities or the Project Inspector during the course of the work.
      b. Special Inspections (not within the Project Inspector's abilities) shall be performed by the Testing Laboratory or other Special Inspector as approved by the Owner and DSA.
         1) All Special Inspections shall be approved by DSA in accordance with CCR-T24, Part 1, Chapter 4, Group 1, Article 5, Section 4-335.
   3. Writing Test Reports
   4. Review of "Continuous Inspection" reports by the Project Inspector.
      a. Portions of the Work requiring "Continuous Inspection" shall be performed by the Project Inspector (if qualified) and all reports will be reviewed by the Testing Laboratory.
   5. Distribute Test Reports to the Owner, Architect, applicable Engineer, Contractor and to DSA.

B. Responsibilities of the Contractor:
   1. Contractor shall provide a Testing Schedule that is in accordance with the following:
      a. Format of the Testing Schedule shall be in accordance with Specification Section – CONSTRUCTION SCHEDULES.

b. Cooperates with the Testing Laboratory's schedule of required testing.
c. Contractor shall coordinate Construction Schedule and Testing Schedule.
1) Format of testing schedule in accordance with Specification Section – CONSTRUCTION SCHEDULES.

2. Cooperation with testing laboratory:
a. Provide access to Work being tested.
b. Provide test samples as selected by testing laboratory.
c. Schedule Work so that there shall be no excessive inspection time.
1) At times that an inspector is required, sufficient work shall be laid out and adequate personnel supplied so that the inspector's time shall be used to full advantage.
2) If inspection costs become excessive because of poor shop or construction procedure, such excess costs will be paid for by the Owner, but deducted from the Contract Price.
d. Inspections and tests required by regulatory agencies shall be the responsibility of and shall be paid for by the Owner unless specified otherwise.
e. Inspections and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.
f. Test Reports:
1) Distribute test reports and related instruction to insure all required re-testing and/or replacement of materials.
g. Payment of Testing:
1) All testing shall be paid for by the Owner.

3. Contractor shall be backcharged for re-testing, excessive distance from the Project Site, or extra testing required because of initial failures.

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
1. Quality Assurance/Control Submittals:
a. Test Reports:
1) Submit four (4) copies of testing laboratory's report.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Testing Laboratory Qualifications:
a. In accordance with the latest Edition of ASTM E-329.

B. Regulatory Requirements and Reference Standards:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
a. In accordance with regulatory agencies and appropriate ASTM Standards.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 SCHEDULES

A. Testing Schedule at the end of this section should be used as a guide only and it is not considered a complete list. Refer to regulatory agency requirements and specific specification section for complete testing requirements.

B. TESTING SCHEDULE

1. 03 15 14 - DRILLED ANCHORS
   a. Tension Tests.
      1) Paid by Owner.
2. 03 20 00 - REINFORCEMENT
   a. Rebar Material per ACI 318, CBC TABLE 1705A.2.1, CBC Sections 1903A.1, 1905A, and 1910A.
      1) Paid by Owner
   b. Continuous Inspection of Welds per ACI 318, CBC TABLE 1705A.2.1, CBC Sections 1903A.8, 1905A, and 1910A.
      1) Paid by Owner
3. 03 30 00 - CAST-IN-PLACE CONCRETE
   a. Cement Material per ACI 318, and CBC Sections 1903A, 1905A, and 1910A.
      1) Paid by Owner
   b. Aggregate Material per ACI 318.
      1) Paid by Owner
   c. Concrete Mix per ACI 318. CBC Sections 1903A and 1910A.
      1) Paid by Owner
   d. Concrete Strength Tests per ACI 318.
      1) Paid by Owner
   e. Concrete Compression Tests per ACI 318.
      1) Paid by Owner
4. 04 22 00 - CONCRETE MASONRY UNITS
   a. Grout Tests/Mortar Tests per CBC Section 2105A.3.
      1) Paid by Owner
   b. Continuous Inspection of Laying Block and Block Cores per THE MASONRY SOCIETY - TMS 402 and TMS 602, as set forth in Tables 3 and 4, Level 3 requirements and Chapter 21A. Testing shall be in accordance of CBC Section 2105A.
      1) Paid by Owner
   c. Concrete Masonry Unit Tests per CBC Section 2105A.6.
      1) Paid by Owner
5. 05 12 00 - STEEL AND FABRICATIONS
   a. Steel Material per CBC Section 1705A.2.
      1) Paid by Owner
   b. High Strength Bolts and installation per CBC Section 1705A, and CBC Section 1705A.2.6.
      1) Paid by Owner
   c. Inspection of Shop and Field Welding per CBC Section 1705A, and CBC Section 1705A.2.5.
      1) Paid by Owner
6. 05 30 00 - METAL DECK
   a. Steel Material per CBC Section 1705A, and CBC Section 1705A.2.2.
      1) Paid by Owner
   b. Inspection of Shop and Field Welds per CBC Section 1705A, and Table 1705A.2.1.
      1) Paid by Owner

7. 06 17 33 - WOOD JOISTS
   a. Continuous Plant Inspection for open web trusses per CBC Section 1705A.5.5.
      1) Paid by Owner
8. 06 18 00 - GLUE-LAMINATED CONSTRUCTION
   a. Continuous Plant Inspection per CBC Sections 1705A.5.4, and 1705A.10.
      1) Paid by Owner
9. 09 22 16 - METAL FRAMING
   a. Metal Stud Material.
      1) Paid by Owner
   b. Metal Stud Welding.
      1) Paid by Owner
10. 09 51 00 - ACOUSTICAL CEILINGS
   a. Main and cross runners, intersection connectors and expansion devices
      1) Paid by Contractor
11. DIV. 22 - PLUMBING
   a. Non-Leaking System
      1) Paid by Contractor
   b. Bacteriological Purity
      1) Paid by Contractor
12. DIV. 23 - HEATING, VENTILATING AND AIR CONDITIONING
   a. Equipment Operation
      1) Paid by Contractor
   b. System Energy Balance
      1) Paid by Contractor
   c. Non-Leaking Hydronic System.
      1) Paid by Contractor
13. DIV. 26 - SERVICE AND DISTRIBUTION
   a. Equipment Operation
      1) Paid by Contractor
   b. Protective Systems
      1) Paid by Contractor
14. DIV. 26 - LIGHTING
   a. Equipment Operation
      1) Paid by Contractor
15. DIV. 27 - MASTER CLOCK AND PUBLIC ADDRESS SYSTEM
   a. Equipment Operation
      1) Paid by Contractor
16. DIV. 28 - FIRE SPRINKLER SYSTEM
   a. All tests required by NFPA #13.
      1) Paid by Contractor
17. DIV. 28 - WET CHEMICAL FIRE SUPPRESSION SYSTEM
   a. All tests required by NFPA #17A.
      1) Paid by Contractor
18. 31 20 00 - EARTHWORK
   a. Compaction Test
      1) Paid by Owner
   b. Inspection of Excavations and Fills per CBC Table 1705A.6.
      1) Paid by Owner
   c. Department of Toxic Substances Control (DTSC) Independent Testing of Imported soil
      1) Paid by Contractor

C. Division of the State Architect "Statement of Structural Tests and Special "Inspections":

1. In addition to the TESTING SCHEDULE cited above, and elsewhere within the documents, DSA requires the Contractor to schedule and manage the following tests to be performed and reported as required for this Project.
2. Failure to schedule these tests is grounds for reduction in Monthly Payment Request authorization, and may delay distribution of the Final Payment.
3. Refer to the approved DSA 103-Listing of Structural Tests and Special Inspections Form.

END OF SECTION

DSA 103-22: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS, 2022 CBC

General

Application Number:	**School Name:**	**School District:**
02-122058	Merced College	Merced Community College District
DSA File Number:	**Increment Number:**	**Date Created:**
24-C1		2024-01-22 16:39:48

IMPORTANT: This form is only a summary list of structural tests and some of the special inspections required for the project. Generally, the structural tests and special inspections noted on this form are those that will be performed by the Geotechnical Engineer of Record, Laboratory of Record, or Special Inspector. The actual complete test and inspection program must be performed as detailed on the DSA approved documents. The appendix at the bottom of this form identifies work NOT subject to DSA requirements for special inspection or structural testing. The project inspector is responsible for providing inspection of all facets of construction, including but not limited to, special inspections not listed on this form such as structural wood framing, high-load wood diaphragms, cold-formed steel framing, anchorage of non-structural components, etc., per Title 24, Part 2, Chapter 17A (2022 CBC).

****NOTE:** Undefined section and table references found in this document are from the CBC, or California Building Code.

KEY TO COLUMNS

1. TYPE	2. PERFORMED BY
Continuous – Indicates that a continuous special inspection is required **Periodic –** Indicates that a periodic special inspection is required **Test –** Indicates that a test is required	**GE (Geotechnical Engineer) –** Indicates that the special inspection shall be performed by a registered geotechnical engineer or his or her authorized representative. **LOR (Laboratory of Record) –** Indicates that the test or special inspection shall be performed by a testing laboratory accepted in the DSA Laboratory Evaluation and Acceptance (LEA) Program. See CAC Section 4-335. **PI (Project Inspector) –** Indicates that the special inspection may be performed by a project inspector when specifically approved by DSA. **SI (Special Inspection) –** Indicates that the special inspection shall be performed by an appropriately qualified/approved special inspector.

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Table 1705A.6, Table 1705A.7, Table 1705A.8

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Geotechnical Reports: Project has a geotechnical report, or CDs indicate soils special inspection is required by GE

	S1. GENERAL:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	a. Verify that: •Site has been prepared properly prior to placement of controlled fill and/or excavations for foundations. •Foundation excavations are extended to proper depth and have reached proper material. •Materials below footings are adequate to achieve the design bearing capacity.	**Periodic**	**GE***	* By geotechnical engineer or his or her qualified representative. (See Appendix (end of this form) form for exemptions.)

	S2. SOIL COMPACTION AND FILL:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Perform classification and testing of fill materials.	**Test**	**LOR***	* Under the supervision of the geotechnical engineer.
☑	**b.** Verify use of proper materials, densities and inspect lift thicknesses, placement and compaction during placement of fill.	**Continuous**	**GE***	* By geotechnical engineer or his or her qualified representative. (Refer to specific items identified in the Appendix (end of this form) form for exemptions where soils SI and testing may be conducted under the supervision of a geotechnical engineer or LOR's engineering manager. In such cases, the LOR's form DSA 291 shall satisfy the soil SI and test reporting requirements for the exempt items.)
☑	**c.** Compaction testing.	**Test**	**LOR***	* Under the supervision of the geotechnical engineer. (Refer to specific items identified in the Appendix (end of this form) for exemptions where soils testing may be conducted under the supervision of a geotechnical engineer or LOR's engineering manager. In such cases, the LOR's form DSA 291 shall satisfy the soil test reporting requirements for the exempt items.)

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Table 1705A.6, Table 1705A.7, Table 1705A.8

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	S3. DRIVEN DEEP FOUNDATIONS (PILES):			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Verify pile materials, sizes and lengths comply with the requirements.	**Continuous**	**GE***	* By geotechnical engineer or his or her qualified representative.
☐	**b.** Determine capacities of test piles and conduct additional load tests as required.	**Test**	**LOR***	* Under the supervision of the geotechnical engineer.
☐	**c.** Inspect driving operations and maintain complete and accurate records for each pile.	**Continuous**	**GE***	* By geotechnical engineer or his or her qualified representative.
☐	**d.** Verify locations of piles and their plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and record any pile damage.	**Continuous**	**GE***	* By geotechnical engineer or his or her qualified representative.
☐	**e.** Steel piles.	Provide tests and inspections per STEEL section below.		
☐	**f.** Concrete piles and concrete filled piles.	Provide tests and inspections per CONCRETE section below.		
☐	**g.** For specialty piles, perform additional inspections as determined by the registered design professional in responsible charge.	*	*	* As defined on drawings or specifications.

	S4. CAST-IN-PLACE DEEP FOUNDATIONS (PIERS):			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Note**
☐	**a.** Inspect drilling operations and maintain complete and accurate records for each pier.	**Continuous**	**GE***	* By geotechnical engineer or his or her qualified representative. (See Appendix (end of this form) for exemptions.)

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	Test or Special Inspection	**Type**	**Performed By**	**Code References and Note**
☐	**b.** Verify pier locations, diameters, plumbness, bell diameters (if applicable), lengths and embedment into bedrock (if applicable); record concrete or grout volumes.	**Continuous**	**GE***	* By geotechnical engineer or his or her qualified representative. (See Appendix (end of this form) for exemptions.)
☐	**c.** Confirm adequate end strata bearing capacity.	**Continuous**	**GE***	* By geotechnical engineer or his or her qualified representative. (See Appendix (end of this form) for exemptions.)
☐	**d.** Concrete piers.	Provide tests and inspections per CONCRETE section below.		

	S5. RETAINING WALLS:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Placement, compaction and inspection of backfill.	**Continuous**	**GE***	**1705A.6.1.** * By geotechnical engineer or his or her qualified representative. (See section S2 above).
☐	**b.** Placement of soil reinforcement and/or drainage devices.	**Continuous**	**GE***	* By geotechnical engineer or his or her qualified representative.
☐	**c.** Segmental retaining walls; inspect placement of units, dowels, connectors, etc.	**Continuous**	**GE***	* By geotechnical engineer or his or her qualified representative. See DSA IR 18-2.
☐	**d.** Concrete retaining walls.	Provide tests and inspections per CONCRETE section below.		
☐	**e.** Masonry retaining walls.	Provide tests and inspections per MASONRY section below.		

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Table 1705A.6, Table 1705A.7, Table 1705A.8

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	S6. OTHER SOILS:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Soil Improvements	**Test**	**GE***	Submit a comprehensive report documenting final soil improvements constructed, construction observation and the results of the confirmation testing and analysis to CGS (California Geological Survey) for final acceptance. * By geotechnical engineer or his or her qualified representative.
☐	**b.** Inspection of Soil Improvements	**Continuous**	**GE***	* By geotechnical engineer or his or her qualified representative.
☐	**c.**			

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Table 1705A.3; ACI 318-19 Sections 26.12 & 26.13

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	C1. CAST-IN-PLACE CONCRETE			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Verify use of required design mix.	**Continuous**	**SI**	**Table 1705A.3 Item 5, 1910A.1.**
☑	**b.** Identifiy, sample, and test reinforcing steel.	**Test**	**LOR**	**1910A.2;** ACI 318-19 Ch.20 and Section 26.6.1.2; DSA IR 17-10. (See Appendix (end of this form) for exemptions.)
☑	**c.** During concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	**Test**	**LOR**	**Table 1705A.3 Item 6**; ACI 318-19 Sections 26.5 & 26.12.
☑	**d.** Test concrete (f'_c).	**Test**	**LOR**	**1905A.1.17;** ACI 318-19 Section 26.12.
☑	**e.** Batch plant inspection: **Continuous**	**See Notes**	**SI**	Default of **'Continuous'** per **1705A.3.3**. If approved by DSA, batch plant inspection may be reduced to **'Periodic'** subject to requirements in Section **1705A.3.3.1,** or not required per **1705A.3.3.2.** See IR 17-13. (See Appendix (end of this form) for exemptions.)
☐	**f.** Welding of reinforcing steel.	Provide special inspection per STEEL, Category S/A4(d) & (e) and/or S/A5(g) & (h) below.		

	C2. PRESTRESSED / POST-TENSIONED CONCRETE (IN ADDITION TO SECTION C1):			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Sample and test prestressing tendons and anchorages.	**Test**	**LOR**	**1705A.3.4, 1910A.3**
☐	**b.** Inspect placement of prestressing tendons.	**Periodic**	**SI**	**1705A.3.4, Table 1705A.3 Items 1 & 9.**

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	Test or Special Inspection	Type	Performed By	Code References and Notes
☐	**c.** Verify in-situ concrete strength prior to stressing of post-tensioning tendons.	**Periodic**	**SI**	**Table 1705A.3 Item 13.** Special inspector to verify specified concrete strength test prior to stressing.
☐	**d.** Inspect application of post-tensioning or prestressing forces and grouting of bonded prestressing tendons.	**Continuous**	**SI**	**1705A.3.4, Table 1705A.3 Item 9;** ACI 318-19 Section 26.13

	C3. PRECAST CONCRETE (IN ADDITION TO SECTION C1):			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Inspect fabrication of precast concrete members.	**Continuous**	**SI**	ACI 318-19 Section 26.13, and PCI MNL-128 and -130.
☐	**b.** Inspect erection of precast concrete members.	**Periodic**	**SI***	**Table 1705A.3 Item 10.** * May be performed by PI when specifically approved by DSA.
☐	**c.** For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements (MDE or HDE) in structures assigned to Seismic Design Category D, E or F, inspect such connections and reinforcement in the field for: 1. Installation of the embedded parts 2. Completion of the continuity of reinforcement across joints. 3. Completion of connections in the field.	**Continuous**	**SI**	Table 1705A.3; ACI 318-19 Section 26.13.1.3; ACI 550.5
☐	**d.** Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5.	**Periodic**	**SI**	Table 1705A.3; ACI 318-19 Section 26.13.1.3; ACI 550.5

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Table 1705A.3; ACI 318-19 Sections 26.12 & 26.13

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	C4. SHOTCRETE (IN ADDITION TO SECTION C1):			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Inspect shotcrete placement for proper application techniques.	**Continuous**	**SI**	**1705A.3.9, Table 1705A.3 Item 7, 1908A.1, 1908A.2, 1908A.3.** See ACI 506.2-13 Section 3.4, ACI 506R-16.
☐	**b.** Sample and test shotcrete (f'_c).	**Test**	**LOR**	**1908A.2, 1705A.3.9**

	C5. POST-INSTALLED ANCHORS:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Inspect installation of post-installed anchors	**See Notes**	**SI***	**1617A.1.19, Table 1705A.3 Item 4a (Continuous) & 4b (Periodic), 1705A.3.8** (See Appendix (end of this form) for exemptions). ACI 318-19 Section 26.13. * May be performed by the project inspector when specifically approved by DSA.
☑	**b.** Test post-installed anchors.	**Test**	**LOR**	**1910A.5.** (See Appendix (end of this form) for exemptions.)

	C6. OTHER CONCRETE:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.**			

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1705A.4; TMS 602-16, Tables 3 and 4.

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	M1. STRUCTURAL MASONRY: **(f'm = 2000 psi)**			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Mill certificate indicates compliance with requirements for reinforcement, anchors, ties, fasteners and metal accessories. See item C1(b) for identification, sampling and testing of reinforcing steel.	**Periodic**	**SI***	**2103A.4**; TMS 602-16 Article 1.5B.2 & 2.4. * To be performed by qualified LOR representative. Applicable testing by LOR. See IR 17-10 for unidentified reinforcing steel.
☑	**b.** Producer's certificate of compliance for masonry units, mortar and grout materials.	**Test**	**LOR**	**1705A.4, 2103A.2, 2103A.3, 2103A.5;** TMS 602-16 Articles 1.5B.2 2.1, 2.2, 2.6A and 2.6B, and Table 6 footnote 3.
☑	**c.** Test masonry (f'_m).	**Test**	**LOR**	**1705A.4. For Unit Strength: 2105A.3**; TMS 602-16 Articles 1.4B.2 ,1.5B.1 & 1.5B.2. **For Prism (required when f'_m > 2000 psi):2105A.2;** TMS 602-16 Articles 1.4B.3, 1.4B.4, 1.5B.1 & 1.5B.2.
☑	**d.** Verify proportions or properties of site-prepared, premixed or preblended mortar.	**Periodic**	**SI**	TMS 602-16, Table 3 (row 5), Table 4 Item 1a. DSA PR 20-01. (See Appendix (end of this form) for exemptions.)
☑	**e.** Verify proportions or properties of site-prepared, premixed or preblended grout.	**Periodic**	**SI**	TMS 602-16, Table 3 (row 5), Table 4 Item 2d. (See Appendix (end of this form) for exemptions.)
☑	**f.** Batch plant inspection: **Continuous**	**See Notes**	**SI**	Default of **'Continuous'** per **1705A.3.3**. If approved by DSA, batch plant inspection may be reduced to **'Periodic'** subject to requirements in Section **1705A.3.3.1,** or not required per **1705A.3.3.2.** See IR 17-13. Refer to TMS 602-16 Table 3 and Table 4, Item #3a. (See Appendix (end of this form) for exemptions.)
☑	**g.** Test core-drilled samples.	**Test**	**LOR**	**2105A.4**. (See Appendix (end of this form) for exemptions.)
☑	**h.** Inspect preparation of prisms.	**Continuous**	**SI**	TMS 602-16 Articles 1.4.B.3 & 1.4.B.4 & Table 4 Item 4.
☑	**i.** Verify size, location and condition of all dowels, construction supporting masonry, etc.	**Periodic**	**SI**	

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1705A.4; TMS 602-16, Tables 3 and 4.

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	Test or Special Inspection	Type	Performed By	Code References and Notes
☑	**j.** Verify size, grade and type of reinforcement, connectors, and anchor bolts. Verify size and location of structural members.	**Periodic**	**SI**	TMS 602-16 Table 4, Items 1c & 3c.
☑	**k.** Inspect placement of reinforcement, anchor bolts, and connectors.	**Continuous**	**SI**	TMS 602-16 Table 4 Item 2c.
☑	l. Placement, consolidation, and reconsolidation of grout.	**Continuous**	**SI**	TMS 602-16 Table 4 Item 3h.
☑	**m.** Inspect placement of masonry units and construction of mortar joints.	**Periodic**	**SI**	TMS 602-16 Table 4 Item 3b.
☑	**n.** Verify preparation, construction and protection of masonry during cold weather (temperature below 40^{o} F) or hot weather (temperature above 90^{o} F).	**Periodic**	**SI***	TMS 602-16 Table 4 Item 3f. * May be performed by the project inspector when specifically approved by DSA.
☑	**o.** Inspect type, size and location of anchors and all other items to be embedded in masonry including other details of anchorage of masonry to structural members, frames and other construction.	**Continuous**	**SI**	TMS 602-16 Table 4 Item 3d.
☑	**p.** Inspect grout space, including mortar protrusions, prior to placement of grout.	**Continuous**	**SI**	TMS 602-16 Table 4 Item 2a.
☐	**q.** Welding of reinforcing steel.	TMS 602-16 Table 4 Item 3e. Provide special inspection per STEEL, Category S/A4(d) & (e) and/or S/A5(g) & (h) below.		

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1705A.4; TMS 602-16, Tables 3 and 4.

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	M2. VENEER OR GLASS BLOCK PARTITIONS:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Verify proportions of site prepared mortar and grout and/or verify certification of premixed mortar.	**Periodic**	**SI**	TMS 602-16 Table 3 (row 5) and Table 4 Items 1a & 2d.
☐	**b.** Inspect placement of units and construction of mortar joints.	**Periodic**	**SI**	TMS 602-16 Table 4 Item 3b.
☐	**c.** Inspect placement of wire, connectors and anchors	**Periodic**	**SI**	TMS 602-16 Table 4 Item 2c.
☐	**d.** Inspect type, size and location of anchors and all other items to be embedded in masonry veneer including details of anchorage of masonry to veneer backing, frames and other construction.	**Periodic**	**SI**	TMS 602-16 Table 4 Item 3d.
☐	**e.** Verify preparation, construction and protection of masonry during cold weather (temperature below 40^{o} F) or hot weather (above 90^{o} F).	**Periodic**	**SI***	TMS 602-16 Table 4 Item 3f. * May be performed by the project inspector when specifically approved by DSA.
☐	**f.** Test adhered veneer bond strength.	**Test**	**LOR**	**1410.2.1;** TMS 402 Article 12.3.2.4. **(Field constructed mock-up laboratory tested in accordance with ASTM C482).**

	M3. POST-INSTALLED ANCHORS IN MASONRY:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Inspect installation of post-installed anchors	**See Notes**	**SI***	**1617A.1.19, 1705A.4, Table 1705A.3 Item 4a (Continuous) & 4b (Periodic);** ACI 318-14 Sections 17.8 & 26.13. * May be performed by the project inspector when specifically approved by DSA. (See Appendix (end of this form) for exemptions.)

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1705A.4; TMS 602-16, Tables 3 and 4.

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	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**b.** Test post-installed anchors.	**Test**	**LOR**	**1705A.4, 1910A.5.** (See Appendix (end of this form) for exemptions.)

	M4. OTHER MASONRY:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.**			

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1705A.2.1, Table 1705A.2.1; AISC 303-16, AISC 341-16, AISC 358-16, AISC 360-16; AISI S100-20; RCSC 2014; AWS D1.1, AWS D1.2, AWS D1.3, AWS D1.4, AWS D1.8

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	S/A1. STRUCTURAL STEEL, COLD-FORMED STEEL AND ALUMINUM USED FOR STRUCTURAL PURPOSES			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Verify identification of all materials and: • Mill certificates indicate material properties that comply with requirements. •Material sizes, types and grades comply with requirements.	**Periodic**	*	**Table 1705A.2.1 Item 3a–3c.** 2202A.1**;** AISI S100-20 Section A3.1 & A3.2, AISI S240-20 Section A3 & A5, AISI S220-20 Sections A4 & A6. * By special inspector or qualified technician when performed off-site.
☑	**b.** Test unidentified materials	**Test**	**LOR**	**2202A.1.**
☑	**c.** Examine seam welds of HSS shapes	**Periodic**	**SI**	DSA IR 17-3.
☑	**d.** Verify and document steel fabrication per DSA-approved construction documents.	**Periodic**	**SI**	Not applicable to cold-formed steel light-frame construction, except for trusses (**1705A.2.4**).
☐	**e.** Buckling restrained braces.	**Test**	**LOR**	Testing and special inspections in accordance with IR 22-4.

	S/A2. HIGH-STRENGTH BOLTS:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Verify identification markings and manufacturer's certificates of compliance conform to ASTM standards specified in the DSA-approved documents.	**Periodic**	**SI**	**Table 1705A.2.1 Items 1a & 1b, 2202A.1;** AISC 360-16 Section A3.3, J3.1, and N3.2; RCSC 2014 Section 1.5 & 2.1; DSA IR 17-8 & DSA IR 17-9.
☑	**b.** Test high-strength bolts, nuts and washers.	**Test**	**LOR**	**Table 1705A.2.1 Item 1c, 2213A.1**; RCSC 2014 Section 7.2; DSA IR 17-8.
☑	**c.** Bearing-type ("snug tight") connections.	**Periodic**	**SI**	**Table 1705A.2.1 Item 2a, 1705A.2.6, 2204A.2**; AISC 360-16 J3.1, J3.2, M2.5 & N5.6; RCSC 2014 Section 9.1; DSA IR 17-9.
☑	**d.** Pretensioned and slip-critical connections.	*	**SI**	**Table 1705A.2.1 Items 2b & 2c, 1705A.2.6, 2204A.2;** AISC 360-16 J3.1, J3.2, M2.5 & N5.6; RCSC 2014 Sections 9.2 & 9.3; DSA IR 17-9. *"Continuous" or "Periodic" depends on the tightening method used.

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1705A.2.1, Table 1705A.2.1; AISC 303-16, AISC 341-16, AISC 358-16, AISC 360-16; AISI S100-20; RCSC 2014; AWS D1.1, AWS D1.2, AWS D1.3, AWS D1.4, AWS D1.8

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	S/A3. WELDING:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Verify weld filler material identification markings per AWS designation listed on the DSA-approved documents and the WPS.	**Periodic**	**SI**	**1705A.2.5, Table 1705A.2.1 Items 4 & 5**; AWS D1.1 and AWS D1.8 for structural steel; AWS D1.2 for Aluminum; AWS D1.3 for cold-formed steel; AWS D1.4 for reinforcing steel; DSA IR 17-3.
☑	b. Verify weld filler material manufacturer's certificate of compliance.	**Periodic**	**SI**	DSA IR 17-3.
☑	**c.** Verify WPS, welder qualifications and equipment.	**Periodic**	**SI**	DSA IR 17-3.

	S/A4. SHOP WELDING (IN ADDITION TO SECTION S/A3):			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Inspect groove welds, multi-pass fillet welds, single pass fillet welds > 5/16", plug and slot welds.	**Continuous**	**SI**	**Table 1705A.2.1 Items 5a.1–4;** AISC 360-16 (and AISC 341-16 as applicable); DSA IR 17-3.
☑	b. Inspect single-pass fillet welds ≤ 5/16", floor and roof deck welds.	**Periodic**	**SI**	**1705A.2.2, Table 1705A.2.1 Items 5a.5 & 5a.6;** AISC 360-16 (and AISC 341-16 as applicable); DSA IR 17-3.
☐	**c.** Inspect welding of stairs and railing systems.	**Periodic**	**SI**	**1705A.2.1**; AISC 360-16 (and AISC 341-16 as applicable); AWS D1.1 & D1.3; DSA IR 17-3.
☐	**d.** Verification of reinforcing steel weldability other than ASTM A706.	**Periodic**	**SI**	**1705A.3.1**; AWS D1.4; DSA IR 17-3. Verify carbon equivalent reported on mill certificates.
☐	**e.** Inspect welding of reinforcing steel.	**Continuous**	**SI**	**Table 1705A.2.1 Item 5b, 1705A.3.1, Table 1705A.3 Item 2, 1903A.8;** AWS D1.4; DSA IR 17-3.

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	Test or Special Inspection	Type	Performed By	Code References and Notes
	S/A5. FIELD WELDING (IN ADDITION TO SECTION S/A3):			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Inspect groove welds, multi-pass fillet welds, single pass fillet welds > 5/16", plug and slot welds.	**Continuous**	**SI**	**Table 1705A.2.1 Items 5a.1–4;** AISC 360-16 (AISC 341-16 as applicable); DSA IR 17-3.
☑	b. Inspect single-pass fillet welds ≤ 5/16".	**Periodic**	**SI**	**Table 1705A.2.1 Item 5a.5;** AISC 360-16 (AISC 341-16 as applicable); DSA IR 17-3.
☑	**c.** Inspect end-welded studs (ASTM A-108) installation (including bend test).	**Periodic**	**SI**	**2213A.2**; AISC 360-16 (AISC 341-16 as applicable); AWS D1.1; DSA IR 17-3.
☑	**d.** Inspect floor and roof deck welds.	**Periodic**	**SI**	**1705A.2.2, Table 1705A.2.1 Item 5a.6;** AISC 360-16 (AISC 341-16 as applicable); AWS D1.3; DSA IR 17-3.
☑	**e.** Inspect welding of structural cold-formed steel.	**Periodic**	**SI***	**1705A.2.5; AWS D1.3; DSA IR 17-3.** The quality control provisions of AISI S240-20 Chapter D shall also apply. * May be performed by the project inspector when specifically approved by DSA.
☐	**f.** Inspect welding of stairs and railing systems.	**Periodic**	**SI***	**1705A.2.1;** AISC 360-16 (AISC 341-16 as applicable); AWS D1.1 & D1.3; DSA IR 17-3. * May be performed by the project inspector when specifically approved by DSA.
☐	**g.** Verification of reinforcing steel weldability.	**Periodic**	**SI**	**1705A.3.1**; AWS D1.4; DSA IR 17-3. Verify carbon equivalent reported on mill certificates.
☐	**h.** Inspect welding of reinforcing steel.	**Continuous**	**SI**	**Table 1705A.2.1 Item 5b, 1705A.3.1, Table 1705A.3 Item 2, 1903A.8;** AWS D1.4; DSA IR 17-3.

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1705A.2.1, Table 1705A.2.1; AISC 303-16, AISC 341-16, AISC 358-16, AISC 360-16; AISI S100-20; RCSC 2014; AWS D1.1, AWS D1.2, AWS D1.3, AWS D1.4, AWS D1.8

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	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
	S/A6. NONDESTRUCTIVE TESTING:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Ultrasonic	**Test**	**LOR**	**1705A.2.1, 1705A.2.5;** AISC 341-16 J6.2, AISC 360-16 N5.5; AWS D1.1, AWS D1.8; DSA IR 17-2.
☐	**b.** Magnetic Particle	**Test**	**LOR**	**1705A.2.1, 1705A.2.5;** AISC 341-16 J6.2, AISC 360-16 N5.5; AWS D1.1, AWS D1.8; DSA IR 17-2.
☐	**c.**	**Test**	**LOR**	

	S/A7. STEEL JOISTS AND TRUSSES:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Verify size, type and grade for all chord and web members as well as connectors and weld filler material; verify joist profile, dimensions and camber (if applicable); verify all weld locations, lengths and profiles; mark or tag each joist.	**Continuous**	**SI**	**1705A.2.3, Table 1705A.2.3;** AWS D1.1; DSA IR 22-3 for steel joists only. **1705A.2.4;** AWS D1.3 for cold-formed steel trusses.

	Test or Special Inspection	Type	Performed By	Code References and Notes
	S/A8. SPRAYED FIRE-RESISTANT MATERIALS:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Examine structural steel surface conditions, inspect application, take samples, measure thickness and verify compliance of all aspects of application with DSA-approved documents.	**Periodic**	**SI**	**1705A.15, 1705A.15.1, 1705A.15.2, 1705A.15.3, 1705A.15.4, 1705A.15.5, 1705A.15.6.**
☐	**b.** Test density.	**Test**	**LOR**	**1705A.15.1, 1705A.15.5, ASTM E605**
☐	**c.** Bond strength adhesion/cohesion.	**Test**	**LOR**	**1705A.15.1, 1705A.15.6, ASTM E736**

	Test or Special Inspection	Type	Performed By	Code References and Notes
	S/A9. ANCHOR BOLTS AND ANCHOR RODS:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Anchor Bolts and Anchor Rods	**Test**	**LOR**	Identify, sample and test anchor bolts and anchor rods **not** meeting exemptions identified in Section 1 of IR 17-11.
☐	**b.** Threaded rod not used for foundation anchorage.	**Test**	**LOR**	Identify, sample and test threaded rods **not** meeting exemptions identified in Section 1 of IR 17-11.

	Test or Special Inspection	Type	Performed By	Code References and Notes
	S/A10. STORAGE RACK SYSTEMS:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Materials used, to verify compliance with one or more of the material test reports in accordance with the approved construction documents.	**Periodic**	**SI**	Table 1705A.13.7
☐	**b.** Fabricated storage rack elements.	**Periodic**	**SI**	1704A.2.5; Table 1705A.13.7

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	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**c.** Storage rack anchorage installation.	**Periodic**	**SI**	ANSI/MH16.1 Section 7.3.2; Table 1705A.13.7
☐	**d.** Completed storage rack system to indicate compliance with the approved construction documents.	**Periodic**	**SI***	Table 1705A.13.7; * May be preformed by the project inspector when specifically approved by DSA.

	S/A11. Other Steel			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.**			

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	X1. OTHER:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Load test for identified product(s):	**Test**	**LOR**	**1709A.2, 1709A.3**. Testing is not required for: 1) a product with a valid evaluation service report per DSA IR A-5, or 2) a product that can be justified by structural calculation.
☐	**b.** Installation torque for non-HS bolts	**Continuous**	**SI***	Applicable to communication towers identified as Essential Service Facility Projects (ESFP). Calibrated wrench use required, verified by SI during installation. DSA Policy PL 18-01: Communication Towers, Poles and Buildings Utilized by State Agencies for Essential Services Communications.*EXCEPTION: Non-ESFP may use PI without need for notification to DSA.
☐	**c.**			

Appendix: Work Exempt from DSA Requirements for Structural Tests / Special Inspections

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Exempt items given in DSA IR A-22 or the 2022 CBC (including DSA amendments) and those items identified below with a check mark by the design professional are NOT subject to DSA requirements for the structural tests **/** special inspections noted. **Items marked as exempt shall be identified on the approved construction documents**. The project inspector shall verify all construction complies with the approved construction documents.

	SOILS:
☐	1. Deep foundations acting as a cantilever footing with a design based on minimum allowable pressures per CBC Table 1806A.2 and without a geotechnical report for the following cases: A) free standing sign or scoreboard, B) cell or antenna towers and poles less than 35'-0" tall (e.g., lighting poles, flag poles, poles supporting open mesh fences, etc.), C) single-story structure with dead load less than 5 psf (e.g., open fabric shade structure), or D) covered walkway structure with an apex height less than 10'-0" above adjacent grade.
☐	2. Shallow foundations, etc. are exempt from special inspections and testing by a Geotechnical Engineer for the following cases: A) buildings without a geotechnical report and meeting the exception item #1 criteria in CBC Section 1803A.2 supported by native soil (any excavation depth) or fill soil (not exceeding 12" depth per CBC Section 1804A.6), B) soil scarification/recompaction not exceeding 12" depth, C) native or fill soil supporting exterior non-structural flatwork (e.g., sidewalks, site concrete ramps, site stairs, parking lots, driveways, etc.), D) unpaved landscaping and playground areas, or E) utility trench backfill with depth not exceeding 12".

	CONCRETE/MASONRY:
☑	1. Post-installed anchors for the following: A) exempt non-structural components (e.g., mechanical, electrical, plumbing equipment - see item 7 for "Welding" in the Appendix below) given in CBC Section 1617A.1.18 (which replaces ASCE 7-16, Section 13.1.4) or B) interior nonstructural wall partitions meeting criteria listed in exempt item 3 for "Welding" in the Appendix below
☐	2. Concrete batch plant inspection is not required for items given in CBC Section 1705A.3.3.2 subject to the requirements and limitations in that section.
☐	3. Non-bearing non-shear masonry walls may be exempt from certain DSA masonry testing and special inspection items as allowed per DSA IR 21-1. Refer to construction documents for specific exemptions accordingly for each applicable wall condition shown in Appendix A of IR 21-1.
☑	4. Epoxy shear dowels in site flatwork and/or other non-structural concrete.

Appendix: Work Exempt from DSA Requirements for Structural Tests / Special Inspections

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	CONCRETE/MASONRY:
☐	5. Testing of reinforcing bars is not required for items given in CBC Section 1910A.2 subject to the requirements and limitations in that section.

	WELDING:
☑	1. Solid-clad and open-mesh fences, gates with maximum leaf span of 10', and gates with a maximum rolling section of 10' all having an apex height less than 8'-0" above lowest adjacent grade. When located above circulation or occupied space below, these gates/fences are not located within 1.5x gate/fence height (max 8'-0") to the edge of floor or roof.
☐	2. Handrails, guardrails, and modular or relocatable ramps associated with walking surfaces less than 30" above adjacent grade (excluding post base connections per the 'Exception' language in Section 1705A.2.1); fillet welds shall not be ground flush.
☐	3. Non-structural interior cold-formed steel framing spanning less than 15'-0", such as in interior partitions, interior soffits, etc. supporting only self weight and light-weight finishes or adhered tile, masonry, stone, or terra cotta veneer no more than 5/8" thickness and apex less than 20'-0" in height and not over an exit way. Maximum tributary load to a member shall not exceed the equivalent of that occurring from a 10'x10' opening in a 15' tall wall for a header or king stud.
☑	4. Manufactured support frames and curbs using hot rolled or cold-formed steel (i.e., light gauge) for mechanical, electrical, or plumbing equipment weighing less than 2000# (equipment only) (connections of such frames to superstructure elements using welding will require special inspection as noted in selected item(s) for Sections S/A3, S/A4 and/or S/A5 of listing above).
☑	5. Manufactured components (e.g., Tolco, B-Line, Afcon, etc.) for mechanical, electrical, or plumbing hanger support and bracing (connections of such components to superstructure elements using welding will require special inspection as noted in selected item(s) for Sections S/A3, S/A4 and/or S/A5 of listing above).
☑	6. TV Brackets, projector mounts with a valid listing (see DSA IR A-5) and recreational equipment (e.g., playground structures, basketball backstops, etc.) (connections of such elements to superstructure elements using welding will require special inspection as noted in selected item(s) for sections S/A3, S/A4 and/or S/A5 located in the Steel/Aluminum category of listing above).

Appendix: Work Exempt from DSA Requirements for Structural Tests / Special Inspections

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	WELDING:
☑	7. Any support for exempt non-structural components given in CBC Section 1617A.1.18 (which replaces ASCE 7-16, Section 13.1.4) meeting the following: A) when supported on a floor/roof, <400# and resulting composite center of mass (including component's center of mass) ≤4' above supporting floor/roof, B) when hung from a wall or roof/floor, <20# for discrete units or <5 plf for distributed systems.

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Name of Architect or Engineer in general responsible charge:

Grant E. Dodson (C-20,307)

Name of Structural Engineer (When structural design has been delegated):

COLIN P. BLANEY
SE 4377

Signature of Architect or Structural Engineer: Date: 01/23/24

Colin Blaney

Note: To facilitate DSA electronic mark-ups and identification stamp application, DSA recommends against using secured electronic or digital signatures.

LICENSED ARCHITECT
GRANT E. DODSON
No. C-20,307
Ren. 6-30-25
STATE OF CALIFORNIA

DSA STAMP

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 02-122058 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 8/29/2024

DSA 103-22: LIST OF REQUIRED VERIFIED REPORTS, CBC 2022

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1. Soils Testing and Inspection: Geotechnical Verified Report Form DSA 293
2. Structural Testing and Inspection: Laboratory Verified Report Form DSA 291
3. Concrete Batch Plant Inspection: Laboratory Verified Report Form DSA 291
4. Post-installed Anchors: Laboratory Verified Report Form DSA 291, or, for independently contracting SI, Special Inspection Verified Report Form DSA 292
5. Masonry Inspection: Laboratory Verified Report Form DSA 291, or, for independently contracting SI, Special Inspection Verified Report Form DSA 292
6. Shop Welding Inspection: Laboratory Verified Report Form DSA 291, or, for independently contracting SI, Special Inspection Verified Report Form DSA 292
7. Field Welding Inspection: Laboratory Verified Report Form DSA 291, or, for independently contracting SI, Special Inspection Verified Report Form DSA 292
8. High-Strength Bolt Installation Inspection: Laboratory Verified Report Form DSA 291, or, for independently contracting SI, Special Inspection Verified Report Form DSA 292

SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all Temporary Utilities, Support Facilities, and Protection Facilities materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Shop Drawings:
      a. Project Sign.
   2. Quality Assurance/Control Submittal:
      a. Copy of Application to APCD for Dust Prevention and Control Plan.
      b. Copy of approved Application to APCD for Dust Prevention and Control Plan.
      c. Temporary Project Enclosure Plan.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
      a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA), in the area where the project is located.
      b. CAL/OSHA California Division of Occupational Safety and Health Administration
      c. EPA Environmental Protection Agency

B. Dust Prevention and Control Plan:
   1. Prior to commencing the Work, prepare a Dust Prevention and Control Plan and obtain review and approval of the Air Pollution Control District (APCD) in the area where the project is located.
      a. Prepare application and file with appropriate fees to APCD upon completion of Dust Prevention and Control Plan.
   2. The Dust Prevention and Control Plan shall specify the methods of control that will be utilized, demonstrate the availability of needed equipment and personnel, and identify a responsible individual who, if needed, can authorize implementation of additional measures.
   3. All construction shall comply with applicable elements of the APCD’s regulations.

4. The Dust Prevention and Control Plan shall include, but not be limited to, the following:
    a. Contractor's name and project identification information.
    b. Procedures and measures to be implemented, but not be limited to:
        1) All material excavated or graded shall be sufficiently watered to prevent excessive amounts of dust.
        2) During periods of high winds, all clearing, grading, earth moving, or excavation shall cease when dust control measures are unable to avoid visible plumes.
        3) All dust producing material transported off site shall be either sufficiently watered or securely covered to prevent excessive amounts of dust.
        4) The area disturbed by clearing, earth moving, or excavation activities shall be minimized at all times.
        5) All watering of areas shall be only to the extent required to keep the soil particles in a moist condition and not to the extent that erosion of surface soil occurs.
        6) To control general fugitive dust, on-site vehicle speed shall be limited to 15 mph.
        7) All areas with vehicle traffic shall be watered periodically for stabilization of dust emissions.
        8) Periodically streets adjacent to the project site shall be cleaned as required to remove silts which may have accumulated from construction activities.

C. Temporary Project Enclosure Plan:
1. Prior to commencing the Work, prepare a Temporary Project Enclosure Plan indicating the protection of people, animals, and partial and fully completed work until occupancy by the Owner.
2. Identify temporary egress from existing occupied facilities and as required by authorities having jurisdiction.
3. The Temporary Project Enclosure Plan shall include, but not be limited to, the following:
    a. Contractor's name and project identification information.
    b. Indicate the duration of the proposed measures based on the completion of the work as a whole and if any phases of work are identified.
    c. Indicate proposed temporary fencing and potential exit and entry paths.
        1) Show gate and door locations and indicate who has access.
    d. Indicate type of material used for temporary fencing.
    e. Indicate proposed temporary roads and paved areas.
    f. Indicate proposed temporary offices and storage areas.

D. Copy of approved Fire Protection Program:
1. Contractor shall be responsible for the development, implementation, and maintenance of a written plan establishing a fire prevention program at the project site applicable throughout all phases of the construction, repair, alteration, or demolition work in accordance with CFC Chapter 33, Section 3308 and sub-sections.
2. It is the Contractor's responsibility to contact local Fire Authority to discuss the plan.
    a. A copy of the report should be made available to the Project Inspector and local Fire Authority.
3. Approval Required: Prior to commencing the Work, prepare a Fire Protection Program and obtain review and approval from the local Fire Authority in the area where the project is located.
4. Plan shall address at a minimum:
    a. Each phase of the construction, repair, alteration, or demolition work.
    b. Designate responsible program superintendent in accordance with CFC 3308.2.
    c. Duties of staff.
    d. Staff training requirements.
    e. Prefire plans.
    f. Fire protection devices.

g. Hot work operations.
h. Impairment of fire protection systems.
i. Temporary covering of fire protection devices.

1.4 PROJECT CONDITIONS

A. Environmental Requirements:

1. Heating and Cooling:
   a. Provide temporary heating and cooling required by construction activities for curing, acclimating the building or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed, and is maintained prior, during and after the installation in accordance with the exterior or interior building materials temperature and humidity guidelines.
      1) Do not use heating units that contribute moisture to the enclosed spaces under construction.
2. Ventilation and Humidity Control:
   a. Provide temporary ventilation required by construction activities for curing, acclimating the building or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
      1) Exterior Moisture Control:
         a) Perform the installation of all exterior building cladding only after the substrate to which they are being applied is dry and ready to receive them. Do not apply any cladding if it will trap moisture inside a wall or roof cavity (i.e. insulation that has become wet for whatever reasons).
      2) Interior Moisture Control:
         a) Perform the installation of all interior moisture sensitive building materials only after the building or space is acclimated to the final environmental conditions under which the building is to be operated in accordance within the Owner's humidity control guidelines.
   b. Maintain a consistent humidity in accordance with the guidelines for those materials in the space at least seven (7) days prior to installation of any moisture sensitive materials (i.e. Veneer Plaster, Gypsum Board, Ceiling Tiles, Wood Sensitive Floors, other Flooring sensitive to moisture levels, Interior Painting, etc.).
   c. Maintain the same levels or temperature and humidity during the installation of those materials, and after the installation of those materials until the building's own mechanical systems can be turned on to maintain the facility within the Owner's temperature and humidity control guidelines.
   d. Replace any materials that have become wet and damaged due to the Contractor not properly protecting installed building materials at no additional cost to the Owner.
3. Dust control:
   a. Perform work in a manner as to minimize the spread of dust and flying particles.
   b. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other on-site work.
   c. Temporarily cover mechanical equipment and ductwork openings to prevent the entry of construction dust and debris.
4. Burning: No burning will be allowed on-site.

5. Noise Control:
   a. Stationary noise sources shall be of a low-noise emission design, consistent with the best available noise reduction technology.
   b. The hours of operation of noise-generating equipment shall be restricted to 6:00 a.m. to 7:00 p.m. Monday through Friday, and to 8:00 a.m. to 6:00 p.m. on Saturday and Sunday.
   c. Mufflers shall be required on all gas and diesel-powered equipment.

B. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Cultural Resources:
   a. The Contractor is advised of the possibility that cultural resources may be discovered during project activities.
   b. If any cultural or paleontological materials are uncovered during project activities, work in the area or any area reasonably suspected to overlie adjacent remains shall be stopped and the Architect advised of the discovery. The Architect will notify the appropriate agency and the work shall remain stopped until professional cultural resources evaluation and/or data recovery excavation can be planned and implemented. Appropriate measures to protect remains from accidents, looting, and vandalism shall be implemented immediately on discovery.
   c. If human remains are discovered, the work in the area or any area reasonably suspected to overlie adjacent remains shall be stopped and the County Coroner and the Architect shall be notified immediately. Appropriate measures to protect remains from accidents, looting, and vandalism shall be implemented immediately on discovery. The work shall remain stopped until professional cultural resources evaluation and/or recovery excavation can be planned and implemented.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Fire Protection During Construction:
1. Provide Temporary Fire Protection per CFC Chapter 33 during demolition and construction.

B. Field Offices:
1. General Note: Provide one (1) 2A:10B:C Wall Surface Mounted Fire Extinguisher in each field office as a minimum per the CSFM.
2. Contractor's Field Office:
   a. Size: Nominal 8 feet wide minimum, approximately 200 square feet minimum.
   b. Equipment:
      1) Table for review of Drawings.
      2) Files, rack and shelves as required to store Contract Drawings and Project Record Drawings in a neat, orderly manner.
      3) One copy of each code listed in Specification Section - REGULATORY REQUIREMENTS.
      4) Telephone.
      5) Internet Connection.
      6) Plain Paper Copier / FAX Machine.
   c. Facilities:
      1) Adequate light and power.

2) Adequate heating, ventilation and air conditioning.

d. Control and Access:

1) Door shall be lockable and key shall be supplied to Architect and access shall be limited to Owner, Architect, Inspector and Contractor.

e. All of the above items shall be subject to Architect's approval.

3. Project Inspector's Field Office:

a. Size: Nominal 8 feet wide minimum, approximately 96 square feet minimum.

b. Equipment:

1) Table for review of Drawings.

2) Files, rack and shelves as required to store Contract Drawings and Project Record Drawings in a neat, orderly manner.

3) Space for one copy of each code listed in Specification Section - REGULATORY REQUIREMENTS.

4) Telephone.

5) Internet Connection.

6) Plain Paper Copier / FAX Machine.

c. Facilities:

1) Adequate light and power.

2) Adequate heating, ventilation and air conditioning.

d. Control and Access:

1) Door shall be lockable and key shall be supplied to Architect and access shall be limited to Owner, Architect, Inspector and Contractor.

e. All of the above items shall be subject to Architect's approval.

C. Project Sign:

1. The Contractor shall furnish and erect at location as directed by the Architect one sign board approximately 4 feet x 8 feet, fabricated of 3/4 inch exterior grade plywood with a sturdy frame attached to 4 inch x 4 inch x 14 foot redwood posts set 4 feet in the ground minimum, and substantially braced.
2. The sign to be painted on signboard shall be of design in 4 colors as directed by the Architect.
3. Lettering shall be of style shown, neatly executed by a skilled sign painter.
4. The information to be lettered on sign shall be as furnished by the Architect.

a. Sign will include the names of the Contractor, Owner, Architect, and the project designation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:

1. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
2. Execution of work under this specification section shall constitute acceptance of existing conditions.
3. Obtain all necessary permits and authorizations by regulatory agencies required to perform the work under this section.

3.2 PREPARATION

A. Coordination:

1. Before proceeding, verify plans match existing conditions.
2. Coordinate work under this specification with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:
   1. The Contractor shall verify and protect existing landscaping, asphalt area, concrete walkways, and other site improvmeents to remain on the site before proceeding with the Work.
   2. Prior to starting Work, hose bibbs, utility lines, etc., to be abandoned and removed within the construction area shall be stubbed off outside the limits of construction.
   3. Verify and protect utilities to remain within the construction area and provide special construction for their protection.

3.3 IMPLEMENTATION

A. General:
   1. Perform Work and provide and maintain Temporary Utilities and Temporary Facilities in accordance with the requirements of all regulatory authorities having jurisdiction.
   2. Contractors shall cooperate with other contractors and the Owner in the use of the site, Temporary Utilities, Temporary Facilities and shall adjust their operations to maintain harmonious relations and uninterrupted progress of the Work.
   3. The Contractor shall assume all responsibility for the provision and maintenance of these Temporary Utilities and Temporary Facilities and for the provisions of public safety where the operations under this Contract interface with public areas.
   4. Relocate and modify Temporary Utilities and Temporary Facilities, as required by progress of the Work.
   5. Remove Temporary Utilities and Temporary Facilities upon completion of the Project.
   6. Temporary Utilities and Temporary Facilities are to be provided and maintained from commencement of Work until final acceptance.
      a. The Contractor shall pay all charges required of him for the duration of the project, including a **2** month period following the date of the Notice of Substantial Completion.

B. Temporary Utilities:
   1. Install temporary service or connect to existing service.
      a. Arrange with Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
         1) Minimum forty-eight (48) hours prior notice to any interruption.
   2. Sewers:
      a. Provide temporary service to remove effluent lawfully.
   3. Storm Drainage:
      a. Provide temporary service as necessary to remove storm water. Work shall be performed in accordance with the requirements of the Storm Water Pollution Prevention Plan (SWPPP), if any. If no SWPPP is required, then follow local authorities having jurisdiction requirements.
   4. Water:
      a. The Contractor will arrange and pay for all water supply for all purposes of construction at a location to be designated at the site. Extensions within the site shall be provided by the Contractor and maintained in a safe and efficient manner.
   5. Electrical:
      a. The Owner will pay and the Contractor shall provide for all electrical facilities and services for all purposes of power and lighting for construction at a location to be designated at the site. Extensions within the site shall be provided by the Contractor and maintained in a safe and efficient manner.
         1) The Contractor shall pay for cost of electrical energy required in connection with the testing of such equipment as generators, transformers, power machinery, and similar equipment installed in the work.
      b. The Contractor will provide electrical energy to all subcontractors as required on or about the premises.

c. The Contractor will provide power outlets having adequate electrical characteristics and lighting of adequate intensity for the use of other contractors within reasonable distances from their needs and within a reasonable period of time after the other contractors have requested them.

6. Telephone:
   a. The Contractor shall provide and pay for all telephone service and telephone equipment in the Field Offices until completion of the Work.
      1) Provide an additional dedicated phone line for modem/network connection in the Project Inspector's Field Office for use by the Architect's representative.
7. Heating:
   a. Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity.
   b. Select UL or FM approved equipment that will not have a harmful effect on completed installations or elements being installed.
      1) Except where use of the permanent heating system is authorized, provide temporary units that do not introduce moisture into the newly constructed building spaces.
      2) Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.
   c. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

C. Temporary Facilities:
1. Support Facilities:
   a. Offices and Storage:
      1) Provide temporary offices and storage facilities located within the construction area.
      2) Protect materials, construction work and their operations from weather, vandalism, and theft.
   b. Sanitary Facilities:
      1) Provide adequate, self-contained toilets as required for all persons employed on the Project.
      2) In no case shall the permanent plumbing fixtures of the Project be used for this purpose.
   c. Temporary Roads and Paved Areas:
      1) Construct and maintain temporary roads and paved areas adequate for construction operations and fire protection during construction.
   d. Traffic Controls:
      1) Maintain access for fire-fighting equipment and access to fire hydrants.
      2) Conduct work and comply with applicable building codes and regulations regarding the use of public streets and sidewalks and the proper barricading and lighting of public thoroughfares surrounding the construction activities.
      3) Provide and maintain access as required to perform work.
      4) Repair all damage as a result of work performed on the project to adjacent roads, streets, drives and walks. Restore to condition as good as existed at commencement of the Work.
   e. Project Sign:
      1) Install project sign as submitted and approved.
      2) No other signs will be allowed on the project.
2. Protection Facilities:
   a. Existing Facilities:

1) Protect existing vegetation, equipment, structures, utilities, and other improvements at project site and on adjacent properties, except those indicated to be removed or altered. Damage occurring during the course of construction shall be repaired to condition at the start of the Work.

b. Environmental:
   1) Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

c. Project Enclosure:
   1) Implement procedures and measures outlined in Temporary Project Enclosure Plan.
   2) Project enclosure shall protect materials, construction work, and operations from vandalism, theft, and to exclude the intrusion of the public into the construction area.

3.4 CLEANING

A. Clean in accordance with Specification Section – PROJECT CLOSEOUT.
   1. At all times, keep the premises free from accumulations of waste materials or rubbish caused by employees or the Work.
   2. Clean all soiled surfaces to remain immediately.
   3. At the completion of the Work, remove all rubbish from and about the building and all tools, scaffolding, and surplus materials and shall leave the Work "broom clean" or its equivalent.

END OF SECTION

SECTION 01 57 23 – STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to implement the Storm Water Pollution Prevention Plan (SWPPP).
   2. Provide all material, labor, equipment and services necessary to comply with the conditions of the Construction General Permit (CGP) No. 2009-0009-DWQ.
   3. Implement the Best Management Practices (BMP) contained within the SWPPP or implement other practices deemed necessary by the Contractor/Qualified SWPPP Practitioner (QSP) to better accomplish the intent of controlling the quality of runoff water from the Project Site.
   4. Submit to the Owner/LRP all reports required for the Annual Report prior to September 1 of each year.

B. This Section does not include:
   1. The Owner's Qualified SWPPP Developer (QSD) will prepare the SWPPP.
   2. The Contractor's Qualified SWPPP Developer (QSD) will prepare the SWPPP.
   3. A Notice of Intent (NOI) to be covered by the CGP will be electronically filed by the Owner/Legally Responsible Person (LRP) with the State Water Resources Control Board (SWRCB). The Owner/LRP will pay the NOI fee and annual fees thereafter when applicable.
   4. If applicable, an Erosivity Waiver will be electronically filed by the Owner/LRP with the SWRCB. The Owner/LRP will pay the Erosivity Waiver fee.
   5. The Annual Report will be electronically filed by the Owner/LRP with the SWRCB by September 1 of each year.
   6. A Notice of Termination (NOT) to terminate the CGP coverage will be electronically filed by the Owner/LRP with the SWRCB at the end of the project upon final stabilization as determined by the owner's QSD.

C. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 DEFINITIONS

A. Acronyms:

1.	BMP	Best Management Practices
2.	CARB	California Air Resources Board
3.	CGP	Construction General Permit Order No. 2009-0009-DWQ
4.	COM	County of Merced
5.	CM	City of Merced
6.	CSMP	Construction Site Monitoring Program
7.	EPA	Environmental Protection Agency
8.	FMFCD	Fresno Metropolitan Flood Control District
9.	NOI	Notice of Intent
10.	NOT	Notice of Termination
11.	NPDES	National Pollution Discharge Elimination System

12. QSD Qualified SWPPP Developer
13. QSP Qualified SWPPP Practitioner
14. SWPPP Storm Water Pollution Prevention Plan
15. SWRCB State Water Resources Control Board
16. RWQCB Regional Water Quality Control Board

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Addenda to the SWPPP.
   2. Reports required by the SWPPP.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
      a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA), in the area where the project is located.
      b. COM County of Merced
      c. CM City of Merced
      d. EPA Environmental Protection Agency
      e. SJVAPCD San Joaquin Valley Air Pollution Control District
      f. SWRCB State Water Resources Control Board
      g. RWQCB Regional Water Quality Control Board

PART 2 - PRODUCTS

2.1 SOURCE QUALITY CONTROL

A. Storm Water Pollution Prevention Plan (SWPPP):
   1. The SWPPP shall be prepared in accordance with the guidelines contained in the CGP issued by the SWRCB under the National Pollution Discharge Elimination System (NPDES) permit program of the EPA.
   2. The intent of the CGP is to protect the quality of receiving waters of the United States by limiting the quantity of pollutants in rainfall runoff from construction sites of one acre or more in area. In order to accomplish this goal, each construction project is required to prepare a SWPPP that will govern construction activities to lessen the probability that pollutants will be present in rainfall runoff from their site.
   3. This site will be covered by the CGP by the time construction begins.
      a. All construction activity must comply with the conditions of the CGP.
      b. A NOI to be covered by the CGP will be filed by the Owner/LRP with the SWRCB and the fees will be paid by the Owner/LRP.
      c. Copies of the NOI will be provided to the Contractor to place in the appropriate Appendix of the SWPPP when the NOI is available.
   4. The BMPs contained in the SWPPP will meet the intent of the CGP.
      a. The Owner does not have any responsibility for selecting or implementing the BMPs proposed by the Contractor and QSP to adequately control the quality of runoff from the site.
      b. The Contractor and QSP must provide, implement, and carry out the BMPs that comply with the CGP regardless of the BMPs contained in the SWPPP.

c. The Contractor and QSP shall bear full responsibility for reviewing the proposed BMPs, ascertaining their ability to provide adequate controls, and implementing the BMPs or implementing others deemed by the Contractor and QSP to better accomplish the intent of controlling the quality of runoff water from the project site.

PART 3 - EXECUTION

3.1 APPLICATION

A. General Requirements:

1. The Contractor shall comply with the conditions of the CGP. The CGP is available at the following website:

www.waterboards.ca.gov/water_issues/programs/stormwater/constpermits.shtml

2. The SWPPP is an aid to the Contractor in complying with the CGP.
3. Under the terms of this Contract, the Contractor is the Operator/Discharger of the Project Site. It is the Contractor's and QSP's responsibility to faithfully and fully implement the BMPs contained in the SWPPP, and other BMPs as required to effectively control the quality of runoff water from the project site.
4. The Contractor shall fully and completely carry out all provisions of the SWPPP and insure that all of the Contractor's forces, including sub-contractors, on the site do the same. The Contractor shall assume full responsibility for the implementation, maintenance and execution of the SWPPP for the life of this project. The Contractor shall be fully liable for penalties, fines, and clean-up costs resulting from the failure of the Contractor's personnel or subcontractor’s personnel to comply with the provisions of the SWPPP, and hold the Owner/LRP harmless from the Contractor's failure to implement the SWPPP as required by the SWRCB,RWQCB, CGP, and the local authority having jurisdiction.
5. The Contractor shall be fully aware of the requirements for the full execution of the SWPPP which are contained in the previously mentioned regulations, the requirements of these specifications for implementing, maintaining, and enforcing the provisions of the SWPPP and the impact that the SWPPP will have on the operation, prosecution and cost of the work. A submittal of a bid on this project will be considered as prima facie evidence that the Contractor fully comprehends these requirements and impacts and has fully allowed for their effect on this project, both in time and cost.
6. The Owner/LRP's QSD shall prepare the Risk Determination, site map, and SWPPP for all construction activities that will occur on the project site. Prior to construction, the Contractor shall review the provided site map, mark any necessary changes due to their planned construction operations, and submit any revisions to the Owner/LRP's QSD. The QSD will amend the SWPPP as necessary and the Owner/LRP will certify the updated SWPPP on the SMARTS website.

B. Best Management Practices (BMPs):

1. The QSP shall conduct inspections weekly and at least once each 24-hour period during extended storm events, to identify and record BMPs that need installation or maintenance to operate effectively. Should the QSP deem the BMPs proposed in the SWPPP are inadequate to meet the requirements of the CGP, or a change occurs in the nature or manner of construction operations not anticipated in the SWPPP, the QSP shall propose alternative BMPs that are equal to or better than those contained in the SWPPP.
2. Should the Contractor implement alternative BMPs, he shall prepare all addenda to the SWPPP required by the CGP and notify the Owner's QSD for review of amendments to the original SWPPP.

3. Failure to implement the BMPs as required to meet the intent of the CGP and the SWPPP is a breech of state and federal laws. Punishment for breaking the law can result in fines and imprisonment.
4. BMPs shall be maintained from the start of construction until final stabilization.

3.2 FIELD QUALITY CONTROL

A. Monitoring of BMPs
   1. Monitoring by QSP
      a. Implement the CSMP (weekly, pre-storm, storm event, post-storm, quarterly inspections) as required by the CGP.
      b. Conduct training and testing as required by the CGP.
      c. Prepare and submit all reports to Owner/LRP and SWRCB as required by the SWPPP and the CGP. The Contractor is advised that the electronic filing of the Annual Report with the SWRCB by the Owner/LRP on behalf of the Contractor does not relieve the Contractor of any responsibility due to his failure to conduct proper inspection, testing, and training as required by the CGP. The Contractor shall bear full liability arising out of failure to conduct the required inspections, training, and testing detailed in the CSMP in the SWPPP.
   2. Monitoring by Owner
      a. The Owner will monitor the Contractor's implementation and maintenance of the BMPs.
      b. Should the Owner determine that the Contractor’s efforts fail to meet the requirements of the CGP, the SWPPP, and SWPPP amendments, the Owner reserves the right to employ any and/or all of the following actions:
         1) Notify the SWRCB of the perceived failure of the Contractor to comply with the CGP and SWPPP.
         2) Withhold an amount of money from the Contractor's Payment Request, equal to the Owner's estimate of the value of the work required to implement and maintain the required BMPs, as well as, provide the required inspection, training, and testing forms.
         3) Hire a separate QSP to perform the work required to implement the CSMP and deduct the costs thereof from the Contractor's Payment.

B. Availability and access to the SWPPP
   1. The Contractor shall keep a minimum of one copy of the SWPPP and Addenda thereto in the following locations:
      a. Contractor's Project Site Field Office.
      b. Contractor's General Business Office.
   2. The SWPPP shall be available for public inspection at any time during normal business hours.

3.3 CLEANING AND REMOVAL

A. Removal of BMPs
   1. Completely remove from the Project Site all materials used to construct and maintain the temporary BMPs upon completion and acceptance of the Project.
   2. Remove all accumulated debris and excess material from the BMPs and surrounding locations, and broom clean all adjacent hardscape surfaces to the satisfaction of the Owner.
   3. All permanent BMPs shall remain on the Project Site. The Owner will be responsible for ongoing inspection and maintenance after final acceptance.

B. Under written agreement and with the approval of the Owner, the Contractor may assign maintenance and removal responsibilities of the project BMPs to a subsequent contractor for later work phases at the Project Site.

3.4 RECORD KEEPING

A. Paper or electronic records of all CSMP inspections, testing, and training reports, including the Annual Report, shall be retained for a period of at least three years. These records shall be available at the project site until construction is completed.

3.5 PAYMENT

A. Full compensation for all costs involved in implementing, and monitoring the implementation of the SWPPP for this project, including inspections, testing, and training, performing corrective measures as required to better implement the SWPPP, providing all labor, materials, and resources to maintain the SWPPP and all required records of the SWPPP, and being full liable for all failures to fulfill the intent and requirements of the CGP set forth by the SWRCB, shall be included in the cost bid for the various items of work and no additional payment will be made therefore.

END OF SECTION

SECTION 01 64 00 – OWNER-FURNISHED ITEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all materials, labor, equipment, and services necessary to prepare for installation for those items, noted or scheduled within the Contract Documents, indicated as follows:
      a. CFCI - Contractor Furnished, Contractor Installed
      b. OFCI - Owner Furnished, Contractor Installed
      c. OFOI - Owner Furnished, Owner Installed
      d. OFVI - Owner Furnished, Vendor Installed

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 DEFINITIONS

A. Unless otherwise defined in the GENERAL CONDITIONS, the following definitions apply for this project:
   1. CFCI: CONTRACTOR FURNISHED, CONTRACTOR INSTALLED
      a. When and if the indication "CFCI" is noted on the drawings or listed in the specifications, such items are shown or listed for information and will be furnished by and installed by the Contractor. Such a designation is listed only for clarity, in order to set the item(s) apart from the OFCI, OFOI, and OFVI related item(s).
      b. All item(s) shown or listed in the drawings and specifications without any indication are in the Contract and are part of the Work unless specifically noted otherwise.
   2. OFCI: OWNER FURNISHED, CONTRACTOR INSTALLED
      a. When and if the indication "OFCI" is noted on the drawings or listed in the specifications, such item(s) are shown or listed for information and will be furnished by Owner and installed by the Contractor. The Contractor shall coordinate and verify all dimensions and details necessary for the proper installation.
   3. OFOI: OWNER FURNISHED, OWNER INSTALLED
      a. When and if the indication "OFOI" is noted on the drawings or listed in the specifications, such item(s) are shown or listed for the purpose of general information and will be furnished and installed by Owner. The Contractor shall coordinate and verify all dimensions and details necessary for proper installation.
   4. OFVI: OWNER FURNISHED, VENDOR INSTALLED
      a. When and if the indication "OFVI" is noted on the drawings or listed in the specifications, such item(s) are shown or listed for information and will be furnished by the Owner and installed by the Vendor. The Contractor shall coordinate and facilitate all work to be completed by the Vendors.

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Coordination Drawings:
      a. Submit installer's coordination drawings or other documents indicating the work of this section with that of related work of other sections for proper interface of the completed work. Installer shall coordinate and obtain approvals from the work of other related sections prior to submitting to the Architect.
      b. The Owner will provide Product Data, Shop Drawings, Piping and Wiring Diagrams, Catalog Data Sheets for any items provided under this Specification Section.
   2. Closeout Submittals in accordance with Specification Sections in Division One:
      a. Project Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
      a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA). Regulatory changes may affect the formulation, availability, or use of the specified coatings. Confirm availability of coatings to be used prior to use, and notify the Architect of any recent changes in the Local California Air District Standards where the Project is located, that may have occurred after the preparation of this specification section.

B. Meetings:
   1. Progress Meetings: Scheduled by the Contractor for the proper performance of the work.
      a. Minimum agenda shall be to review the work progress; discuss field observations, problems, and decisions; identification of any potential problems which may impede planned progress; corrective measures to regain projected schedules; and maintenance of quality and work standards in accordance with manufacturer's warranty requirements.
   2. Final Inspection: Scheduled by the Contractor upon proper completion of the work.
      a. Minimum agenda shall be a walkover inspection to identify problems which may impede the issuance of any warranties or guarantees, and discussion of maintaining the work until substantial completion notice for the project is filed.
   3. Participants (or designated representative of) invited to attend each of the above meetings shall be as follows:
      a. Contractor.
      b. Owner.
      c. Architect.
      d. Installer.
      e. Material Manufacturer(s).
      f. Subcontractors, as appropriate (including any accessory subcontractors).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:

1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage. Damaged products will not be accepted. Contractor shall inspect prior to unloading, for any damaged goods, and if OK, will allow unloading and be responsible for the goods.

B. Acceptance at Site:
1. The Contractor shall accept delivery of any items and the responsibility for all items to be furnished to him by the Owner.

C. Storage and protection:
1. Owner Furnished Equipment: The Owner will coordinate and inform the Contractor as to delivery dates for Owner Furnished Equipment to the Project Site. The Contractor shall be responsible for unloading, uncrating, and protecting such equipment.
2. When only a supporting device, or sub-assembly is to be installed by the Contractor the Owner shall provide only that portion and shall store and safeguard those portions to be installed later by others.
3. All products shall be protected, handled, and stored in complete compliance with the manufacturer's printed instructions to protect the Owner from warranty infringements or loss of the full function of the item specified.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

A. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Examine all preparatory work to determine its suitability and completeness. Notify the responsible Contractor of any deficiencies which must be corrected prior to installation.
3. Be satisfied that all conditions affecting installation, operation or function are suitable for installation of the items scheduled.
4. After installation, and acceptance by the inspector and the Architect, the Contractor shall provide protective guards, covers or barricades as required by the manufacturer.
5. The Contractor shall promptly repair, refurbish, or replace items damaged by his operations to a condition satisfactory to the Owners representatives and at no cost to the Owner.

1.7 WARRANTY

1. The Contractor shall provide access to the installed items or prepared substrates for the inspection of the manufacturers representatives, for the purpose of affirming the warranties scheduled.
2. All work shall be performed in full accordance with the manufacturers warranty requirements and all governing codes.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordination:
1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
a. Prepare all substrate blocking as required by the items Furnished By Owner.
b. Prepare all wiring and piping connections as required by the items Furnished By Owner.

B. Protection:
1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

C. Surface preparation:
1. Prepare surface in accordance with manufacturer's instructions and recommendations.
2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond or installation of materials specified within the Contract Documents.

3.2 INSTALLATION

A. General:
1. In accordance with manufacturer's instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.

B. Layout:
1. Lines shall be straight and true.

C. Material and Equipment to be installed:
1. All items so noted or scheduled to be OFCI shall be unloaded, completely installed and placed in operable condition under this Contract.

3.3 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
1. Clean any soiled surfaces at the end of each day, minimum.
2. In accordance with manufacturer's instructions and recommendations.

END OF SECTION

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SECTION 01 71 23 – FIELD ENGINEERING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following: Section includes requirements governing execution of the work including, but not limited to, the following:
   a. Construction layout
   b. Field engineering and surveying

B. Related Sections: The following Project Manuel Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS
   2. DIVISION 01 SPECIFICATION SECTIONS
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 SUBMITTALS

A. Submit in accordance with specification section – SUBMITTAL PROCEDURES:
   1. Coordination Drawings:
      a. Utility Coordination Drawing(s).
   2. Quality Assurance/Control Submittal:
      a. Qualification Data for Civil Engineer/Surveyor.
      b. Intermediate Certificate of Survey Compliance.
      c. Final Certificate of Survey Compliance.
   3. Closeout Submittals in accordance with the following:
      a. As-built Survey Drawing(s).
      b. Project "Record" Survey Drawing.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Civil Engineer/Surveyor Qualifications:
      a. A professional Civil Engineer or Land Surveyor who is licensed to practice in the State of California.
      b. Has successfully completed three (3) projects of similar scope and size to that indicated for this project.

B. Regulatory Requirements:
   1. In accordance with Specification Section – REGULATORY REQUIREMENTS and the following:
      a. CARB Materials and equipment used for this project shall comply with the current applicable regulations of the California Air Resources Board and the Environmental Protection Agency (EPA), in the area where the project is located.
      b. CM City of Merced, codes and ordinances.
      c. COM County of Merced, codes and ordinances.

C. Certificates:
   1. Intermediate Certificate of Survey Compliance:

a. Provide certification letter on contractor's letterhead stating the project complies with the requirements of the contract documents at the completion of building pad construction and installation of underground utilities outside of building pads is complete. Certification letter must be stamped and signed by the qualified Civil Engineer/Surveyor.

2. Final Certificate of Survey Compliance:
   a. Provide certification letter on contractor's letterhead stating the project complies with the requirement of the contract documents at the completion of all above ground improvements and finish grading.

D. Meetings:
1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
   a. Coordinate the work with all other related work.
   b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
   a. Review for proper installation of work progress.
   b. Identify any installation problems and acceptable corrective measures.
   c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
   a. Inspect and identify any problems which may impede issuance of warranties or guaranties.
   b. Maintain installed work until the Notice of Substantial Completion has been filed.

1.4 PROJECT CONDITIONS OR SITE CONDITIONS

A. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions:
1. The existence and location of underground utilities indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence, location, and elevation of all underground utilities and other construction affecting the Work.
   a. Call a local utility locator service (such as USA – "Underground Service Alert") for the task of locating any project related utilities.
   b. Verify the location and invert elevation at points of connection of sanitary sewer system and storm drainage system.
   c. Accurately document vertical and horizontal measurements and elevations uncovered or verified.

B. Coordination:
1. Before proceeding to lay out the Work, verify layout information shown on the drawings in relation to the property survey, topographic survey, and existing benchmarks.

2. Drawings have been provided showing improvements and underground systems for foundations, storm drainage, sewer, water, gas, mechanical lines, electrical lines, and site improvements. Coordinate and verify the accuracy of the drawing locations and elevations as they relate to each other, with existing utility lines, and building pad earthwork zones of influence.
    a. Provide 1"=20' scaled and dimensioned Utility Coordination Drawing.
    b. No improvements shall be executed until the Utility Coordination Drawing is reviewed by the Architect for general conformance with the Contract Documents.
3. Coordinate Layout of Work performed under other sections of the Specifications.
4. If layout conflicts are encountered, report to Architect and then prepare recommendation(s) for correction.
5. Close and careful coordination is required between work of the Contract and that of any future work to follow.
6. Work under this Contract shall accommodate the installation of future work.

3.2 PREPARATION

A. Existing Utility Information:
    1. Furnish information to public utilities that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

3.3 CONSTRUCTION

A. Layout of Work:
    1. Engage a Civil Engineer/Surveyor to Layout the Work using accepted surveying practices and be responsible for all reference points, benchmarks, lines, elevations, and measurements required for Work under this Contract.
    2. Reference points:
        a. Locate existing permanent benchmarks, control points, and similar reference points before beginning the work.
        b. Do not change or relocate existing benchmarks or control points without approval of the Architect.
        c. Replace lost or destroyed permanent benchmarks and control points. Base replacements on the original survey control points.
    3. Benchmarks:
        a. Establish and maintain a minimum of two (2) permanent benchmarks on the project site, referenced to data established by survey control points.
        b. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
        c. Use established benchmarks and control points to set lines and levels at each floor of construction and elsewhere as needed to locate each element of the Project.
    4. Locate construction access to site parking, storage areas, and temporary facilities and controls.
    5. Locate and layout control lines and levels for structures, foundations, column and wall grids, and floor levels including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels.
        a. Level foundations and piers from two or more locations.
    6. Locate and layout site improvements, including pavement, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
    7. Inform installers of lines and levels to which they must comply.
    8. Check the location, level, and plumb of every major element as the Work progresses.
    9. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.4 FIELD QUALITY CONTROL

A. Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by the Inspector and Architect.

B. Maintain As-built Survey Drawing(s) of all underground, surface, and above ground improvements and grades with measurements for both vertical and horizontals dimensions.
   1. Record all addendum and issued change documents.
   2. Upon project completion stamp and sign As-built Survey Drawing(s).

C. Check documented measurements and elevations at completion of building pads and underground utilities against contract documents. The Contractor shall correct out of compliance Work before proceeding with the next element of Work. As-built Survey Drawing(s) shall be current. When all Work at this stage is in compliance with the contract documents, issue the Intermediate Certificate of Survey Compliance.

D. Check documented measurements and elevations at completion of finish grading and site improvements, except for landscape and irrigation work, against contract documents. The Contractor shall correct out of compliance Work before proceeding with the next element of Work. As-built Survey Drawing(s) shall be complete. When all Work at this stage is in compliance with the contract documents, issue the Final Certificate of Survey Compliance.

E. The Civil Engineer/Surveyor shall prepare Project "Record" Survey Drawing in accordance with Specification Section - PROJECT DOCUMENTS.
   1. The Project "Record" Survey Drawing shall contain all of the vertical and horizontal measurements and elevations of reference points, benchmarks, utility lines, grade contours, grade breaks, building floors, major vegetation, and sitework improvements.
   2. The Project "Record" Survey Drawing shall be stamped and signed by the qualified Civil Engineer/Surveyor.
   3. The As-built Survey Drawing(s) shall used in preparation of the Project "Record" Survey Drawing.

3.5 PROTECTION

A. Preserve and protect permanent benchmarks, control points, reference points, and staking during construction operations.

END OF SECTION

SECTION 01 73 29 – CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary for cutting and patching existing materials, accessories and other related items necessary to remodel the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of Work.

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Coordination Drawings:
      a. Submit any installer's coordination drawings indicating the work of this section with that of related work of other sections for proper interface of the completed work. Installer shall coordinate and obtain approvals from the work of other related sections prior to submitting to the Architect.

1.4 QUALITY ASSURANCE

A. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades.
   1. Review areas of potential interference and conflict.
   2. Coordinate procedures and resolve potential conflicts before proceeding.

B. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

C. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

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E. The Contractor shall do all cutting, fitting or patching of existing construction and his work as may be required to make the several parts come together properly and ready to receive or be received by work of other contractors as shown, or reasonably implied by the drawings and specifications for the completed structure. All work shall be as directed by the Architect to achieve the intended work and degree of finish shown.

F. Any cost caused by defective or ill-timed work shall be borne by the party responsible therefor.

1.5 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.3 FIELD QUALITY CONTROL

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill. ***Do not overcut concrete corners*** – hand chip all corners to prevent over-cutting lines. Cut any masonry pavers at grout lines, and ***don't overcut*** into adjacent brick that is to remain.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

C. Grinding and Sandblasting: Where grinding and sandblasting is required of existing construction, perform in accordance with industry standards for proper preparation of new construction or finishes.

D. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
      a. All hard paving and walk replacement shall be flush with adjacent existing construction. Compact existing subgrade so that there is no settling of adjacent horizontal surfaces greater than 1/4", and that all surfaces are ADA compliant.
      b. When altering surfaces in brick paving, match nearby adjacent horizontal concrete surfaces in color and texture. Take care to protect adjacent brick surfaces from concrete slurry and finishing operations. Clean exposed surfaces of brick immediately so that no signs of adjacent concrete work is seen.
      c. Match existing adjacent exposed aggregate concrete paving (color and texture) when construction is proposed for areas paved with exposed aggregate concrete.
      d. Match existing adjacent colored concrete paving (color and texture) when construction is proposed for areas paved with colored concrete.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
      a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
   4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

E. Insert specific installation requirements if not specified elsewhere. Specific installation requirements are better specified in individual Sections.

END OF SECTION

SECTION 01 74 19 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:
   1. Requirements governing execution of the work including, but not limited to, the following:
      a. Salvaging non-hazardous demolition waste.
      b. Recycling non-hazardous construction and demolition waste.
      c. Disposing of non-hazardous construction and demolition waste.

B. Related Sections: The following Project Manuel Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS
   2. DIVISION 01 SPECIFICATION SECTIONS
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, modernization, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition and site clearing operations.

C. Disposal: Removal off-site of construction and demolition waste and subsequent sale, recycling, reuse, or deposit in landfill acceptable to authorities having jurisdiction.

D. Recycle: Recovery of construction or demolition waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of construction or demolition waste and subsequent sale or reuse in another facility.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements
   1. General:
      a. Achieve end-of-project rate for salvage/recycling of minimum [65][75][90] percent by weight of total non-hazardous construction and demolition waste generated by the Work.
      b. Practice efficient waste management in the use of materials in the course of the Work.
      c. Use all reasonable means to divert construction demolition waste from landfills and incinerators.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section – SUBMITTAL PROCEDURES:
   1. Quality Assurance/Control Submittal:
      a. Waste Management Plan.

b. Waste Management Progress Reports.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS and the following:
      a. CARB Materials and equipment used for this project shall comply with the current applicable regulations of the California Air Resources Board and the Environmental Protection Agency (EPA), in the area where the project is located.
      b. CAL/OSHA California Division of Occupational Safety and Health Administration.
      c. COM County of Merced, codes and ordinances.
      d. CM City of Merced, codes and ordinances.
      e. EPA Environmental Protection Agency.

B. Waste Management Plan:
   1. Prior to commencing the Work, submit Waste Management Plan. The Plan must include, but not limited to, the following:
      a. Contractor's name and project identification information.
      b. Procedures to be implemented.
      c. Materials to be salvaged, recycled, or disposed.
      d. Estimated quantities of material broken down by material categories.
      e. Names and locations of entities who receive salvaged and recycled materials.
      f. Tonnage calculations that demonstrate that the Contractor will salvage, re-use, or recycle the minimum percentage by weight of the construction and demolition waste materials generated by the Work.

C. Waste Management Progress Reports:
   1. Submit the Report with each application for progress payment.
      a. Failure to submit the Report and it supporting documentation can render the application for progress payment incomplete and delay the progress payment.
   2. Each Report must include, but not limited to, the following:
      a. List of material categories.
      b. Weight quantity of waste by material category.
      c. Weight quantity of waste salvaged.
      d. Weight quantity of waste recycled.
      e. Total weight quantity of salvaged and recycled waste by material category.
      f. Weight percentage of waste salvaged and recycled by material category.
      g. Include manifests, weight tickets, receipts, and invoices specifically identifying the salvaged, reused, and recycled materials.
      h. Signature line for Contractor.

D. Meetings:
   1. Pre- Demolition……Schedule prior to the start of work.
      a. Coordinate the work with other work being performed.
      b. Identify any potential problems, which may impede the proper disposal of materials.
      c. Review areas where waste and recycle bins will be located.
      d. Review where salvaged materials will be stored.
      e. Review demolition waste disposal and material recycling procedures and environmental goals per Waste Management Plan with all subcontractors and waste haulers.
   2. Progress:……Scheduled by the Contactor during the performance of the work.
      a. Review for maintaining proper procedures.
      b. Inspect and identify any problems and acceptable corrective measures.

3. Completion:……Scheduled by the Contactor upon proper completion of the work.
    a. Inspect and identify any problems.
    b. Submit final Progress Report summarizing total construction and demolition waste weights, percentages salvaged, recycled, and disposed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Cleaning, handling, and packing:
    1. Salvaged Items shall be handled in such a manner as to assure that they are free from damage.
    2. Salvaged Items shall be cleaned and packed or cleaned and palleted before off-site transport.

B. Storage and protection
    1. Salvaged Items shall be stored in a dry, protected area prior to transport.
    2. Cover with protective waterproof covering providing for adequate air circulation and ventilation.

1.7 PROJECT CONDITIONS

A. Environmental requirements;
    1. Comply with federal, state, and local regulations pertaining to solid waste, recycling, chemical waste, sanitary waste, and noise pollution.
    2. Perform work in a manner as to minimize the spread of dust and flying particles.
    3. No burning will be allowed on-site.

B. Existing conditions:
    1. Examine project site and building(s) and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
    2. Conduct work so as not to interfere unnecessarily with adjacent buildings, roads, streets, drives, and walks.
        a. Do not close or obstruct streets, alleys, walks, or passageways without permission from authorities having jurisdiction and coordinating same with immediate neighbors whose business operation may be affected.
        b. Safety measures shall be taken to insure an uninterrupted flow of traffic around the site as required by local Police and Fire Departments.
    3. Storage or sale of removed items on-site is not permitted.
    ~~4. It is not expected that hazardous materials will be encountered in the Work.~~
        ~~a. Hazardous materials will be removed and disposed of by Owner prior to start of the Work.~~
        ~~b. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.~~
    ~~5.~~4. Hazardous materials are present in buildings and structures to be selectively demolished. The Owner has prepared a report for the Contractor to review and use.
        a. Hazardous material remediation is specified in Specification Section - HAZARDOUS MATERIAL PROCEDURES.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish all materials, tools, equipment, facilities, and services as required for performing the construction and demolition waste disposal work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions:
   1. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
   2. Execution of work under this specification section shall constitute acceptance of existing conditions.
   3. Obtain all necessary permits and authorizations by regulatory agencies required to perform the Work under this Section.

3.2 PREPARATION

A. Coordination:
   1. Before proceeding, verify plans match existing conditions.
   2. Review documents of existing construction provided by Owner against existing conditions.
   3. If conflicts are encountered, report it to the Architect. Then prepare recommendation(s) for correction and submit to Architect for review.
   4. Coordinate work under this specification section with work specified under other sections.

B. Protection:
   1. Property:
      a. Provide temporary weather protection to prevent damage to salvage and recycled items.
      b. All damage inflicted on public and private property and the property of the Owner shall be repaired or restored to the original condition prior to the start of this Work. All repair or replacement work shall be done at no additional cost to the owner.

3.3 IMPLEMENTATION

A. General:
   1. Implement waste management plan as submitted.
   2. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the contract.
   3. Designate and label specific areas on project site necessary for separating materials that are to be salvaged, recycled, reused, and donated.

B. Demolition Waste:
   1. Salvaged items for delivery to Owner or other entity:
      a. Clean salvaged items.
      b. Pack or crate items after cleaning. Identify contents of containers.
      c. Store items in a secure area until pick-up or delivery to Owner.
      d. Transport item to Owner's storage area [on-site][off-site][list address].
      e. Protect items from damage during transport and storage.

2. Salvaged items for reuse in the work:
   a. Clean salvaged items.
   b. Store items in a secure and dry area until ready for installation.
3. Recyclable materials:
   a. Prepare and maintain recyclable waste materials according to recycling facility requirements.
   b. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
   ~~c. Separate recyclable demolition waste from other waste materials. Separate recyclable waste by material type at project site to the maximum extent practical according to approved waste management plan.~~
   ~~d.~~c. Separate recyclable demolition waste from other waste materials. All recyclables may be co-mingled into one bin and separated off-site at the appropriate recycling facility.
      1) Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from the project site.
      2) Include a list of acceptable and unacceptable materials at each container or bin.
      3) Inspect containers and bins for contamination and remove contaminated materials if found.
      4) Processed materials stockpiled on site shall not be mixed with other materials. Shape stockpiles to drain surface water. Cover stockpiles to prevent windblown dust.
      5) Processed material shall be stockpiled away from construction. Do not stockpile within drip line of remaining trees.
   ~~e.~~d. Remove recyclable demolition waste off project property and transport to recycling receiver or processor.
   ~~f.~~e. The following list is of common material types which can be recycled. The list of material types is in no way complete but is representative of materials that can be sorted and recycled as per the intent of this specification section.
      1) Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
      2) Wood: Sort and stack members according to size, type, and length of member.
      3) Metals: Separate metal by type. Stack structural steel members according to size and length. Remove bolts, nuts, washers, and other hardware from members.
      4) Gypsum Board: Stack large clean pieces on wood pallets in a dry location. Remove edge trim and sort with other metals.
      5) Acoustical Ceiling Tile: Stack large clean pieces on wood pallets in a dry location.
      6) Metal Suspension System: Separate metal members including trim and other metals from acoustical ceiling tile and sort with other metals.
      7) Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and any tack strips. Store carpet in a dry location.
      8) Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
      9) Conduit: Reduce conduit to straight lengths and store by type and size.
4. Site clearing waste:
   a. Excavated top soil and land clearing debris not recycled and reused on-site shall be removed to an off-site recycling location or disposed of at a landfill that accepts inert material.

C. Construction Waste:
1. Recyclable materials:
a. Prepare and maintain recyclable waste materials according to recycling facility requirements.
b. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
c. Recycle paper and beverage containers used by on-site workers.
~~d. Separate recyclable construction waste from other waste materials. Separate recyclable waste by material type at project site to the maximum extent practical according to approved waste management plan.~~
~~e.~~d. Separate recyclable construction waste from other waste materials. All recyclables may be co-mingled into one bin and separated off-site at the appropriate recycling facility.
1) Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from the project site.
2) Include a list of acceptable and unacceptable materials at each container or bin.
3) Inspect containers and bins for contamination and remove contaminated materials if found.
~~f.~~e. Remove recyclable construction waste off project property and transport to recycling receiver or processor.
~~g.~~f. The following list is of common material types which can be recycled. The list of material types is in no way complete but is representative of materials that can be sorted and recycled as per the intent of this specification section.
1) Cardboard Packaging: Breakdown into flat sheets. Bundle and store in a dry place.
2) Polystyrene Packaging: Separate and bag materials.
3) Pallets: As much as possible, require deliveries using pallets to remove pallets from the project site. For pallets that remain on-site, breakdown pallets into component wood pieces and comply with requirements for recycling wood.
4) Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
5) Wood: Clean cut-Offs of lumber and grind or chip into small pieces.
6) Gypsum Board: Stack large clean pieces on wood pallets in a dry location.

D. Disposal of Waste:
1. Except for items or materials to be salvaged, recycled, or otherwise reused remove and transport waste materials from project site and legally dispose of them in a manner acceptable to authorities having jurisdiction.
2. Do not allow waste material to accumulate on site.
3. Transport waste in a manner that will prevent spillage on adjacent surfaces and areas.

3.4 CLEANING

1. Clean in accordance with Specification Section – PROJECT CLOSEOUT:
a. Immediately clean any soiled surfaces to remain.

END OF SECTION

SECTION 01 77 20 – PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

C. Work Included:
   1. Project cleanup and coordination of all cleaning work required under all sections of this specification.
   2. Collection of and processing for delivery to the Architect of all Project Record Drawings required under this and other various Sections of the Specifications.
   3. Compile and assemble all required documents, operation data, maintenance manuals, and parts lists for all equipment items provided for this project.
   4. Start-up of all mechanical, electrical, and miscellaneous equipment items; and adjustment required for the performance specified.
   5. Compile and assemble all guarantees, warranties, or other written documentation to establish the requirements outlined under all sections of this specification.
   6. Repair and touch-up on all items damaged during the construction and handling processes.
   7. Furnish maintenance material and spare parts as specified within DIVISIONS 02 through 49 of these specifications.
   8. Deliver to the Architect all assembled copies of those items required in Articles 1 through 6 above for presentation to the Owner.

D. It shall be the responsibility of the Contractor to provide all labor and materials necessary to achieve completion of the items listed under Paragraph A, B and C above, although certain items may be specified under the work of other trades. Periodic removal of debris, cleaning, repair, and testing of times in various areas of the construction site shall be carried out under the direction of the Contractor.

1.2 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Quality Assurance/Control Submittals:
      a. Design Data.
         1) All design data as required by the Contract Documents.
      b. Test Reports:
         1) Submit four (4) copies of reports.

2) Submit four (4) copies of reports required by regulatory requirements.
3) Submit four (4) copies of ICC Evaluation Service Report.
4) Submit four (4) copies of Testing Laboratory's report.
5) All other Test Reports as required by the Contract Documents.

c. Certificates:
1) Submit three (3) copies of certificates.

d. Manufacturer's Instructions:
1) Submit three (3) copies of manufacturer's instructions.

e. Manufacturer's Field Reports:
1) Submit three (3) copies of manufacturer's field reports.

f. Engineering Calculations:
1) Submit four (4) copies of engineering calculations computed and signed by a registered Civil or Structural Engineer in the State of California.

2. Closeout Submittals in accordance with Specification Sections in Division One:
a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
b. Operation Data in accordance with Specification Section - PROJECT CLOSEOUT.
c. Warranty in accordance with Specification Section - WARRANTIES.

3. Project Record Documents:
a. Various Sections of the detailed specifications require Project Record Drawings to be prepared by the Contractor(s). These drawings shall be collected by the Contractor, checked for conformance to the specific requirements, and when completed, delivered to the Architect. The Contractor shall also be responsible for collecting bound operating and maintenance manuals required of all trades supplying equipment, and for delivering them to the Architect.

4. Documents Required for Project Certification
a. Compile and neatly assemble with indexed and labeled tabs, three (3) sets of the required documents for project certification by the State Agencies. The required documents include, but are not limited to, the following;
1) Document Required List "Form" for Project Certification ORS-6.
a) This document shall be used to organize and index the required documents.
2) Project Information "Forms":
a) Project Site Inspector(s) SSS-5.
b) In-Plant Inspector(s), required for re-locatable buildings only SSS-5.
c) Contract Information DSA-102.
3) Final Verified Report "Forms" from the Architect and Engineers:
a) Architect’s Final Verified Report DSA-6A/E.
b) Structural Engineer's Final Verified Report DSA-6A/E.
c) Mechanical Engineer's Final Verified Report DSA-6A/E.
d) Electrical Engineer's Final Verified Report DSA-6A/E.
4) Final Verified Report "Forms" from the Contractor(s) and Inspector(s):
a) Project Site Inspector(s) Final Verified Report DSA-6.
b) Contractor(s) Final Verified Report DSA-6.
c) In-Plant Inspector(s) Final Verified Report DSA-6.
d) Special Inspector(s) Final Verified Report DSA-6.
5) Other Final Verified Reports and Affidavits for:
a) Laboratory - To be signed by Licensed Professional Engineer.
b) Shop Welding and Fabrication - To be signed by AWS/CWI Welding Inspector
c) Field Welding - To be signed by AWS/CWI Welding Inspector
d) High Strength Bolt Installation
e) Glu-Laminated Fabrication

f) Manufactured Trusses
g) Masonry Inspection
h) Engineered Fill - To be signed by the Geotechnical Engineer
i) Bleacher Fabrication
j) Other items required by the State Agencies

6) Notices, Certificates, and Change Orders
   a) Notice of Completion - Signed by the Owner, Notarized and recorded with the County Recorders Office.
   b) Weighmaster Certificate(s)
   c) Automatic Fire Sprinkler System
   d) Fire Alarm System Components
   e) Fire Standpipe System
   f) Fire Suppression System
   g) Smoke Ventilation System
   h) Skylight System
   i) Bleacher System
   j) Change Orders - Signed and fully executed.
   k) Other documents and/or requirements required by the State Agencies

7) Field Visit Reports, Correction Reports, Punch Lists & Final Review Reports
   a) Field Visit Reports from State Agencies
   b) Field Visit Reports from Architect and Engineers
   c) Inspector's Correction Reports
   d) Contractor Punch Lists
   e) Architect, Engineers and Owner Final Review Reports
   f) A jointly signed and notarized Affidavit from the Contractor and Project Inspector (formerly the Inspector of Record), indicating that any and all items of correction noted in the above documents have been corrected (including Testing Laboratory Reports).

1.3 QUALITY ASSURANCE:

A. Safety, Fire and Environmental Protection, and Insurance standards shall be strictly adhered to in all phases of the construction work. It shall be the responsibility of the Contractor to determine the standards applicable to this project as set forth in all codes, regulations, and ordinances having jurisdiction, and as set forth elsewhere in the Specifications.

B. All specific requirements stipulated in, or required by code references included under all sections of DIVISIONS 02 through 49 inclusive of this specification, and as detailed under Article 3.4 of this Section, shall be required under this Contract.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Materials:
   1. Use only those specified materials or types of materials recommended and approved by the manufacturer of the item to be cleaned.

B. Touch-Up Materials:

1. Use only those materials furnished by or as recommended and approved by the manufacturer of the item to be touched up. Colors and finish characteristics shall exactly match the base material and extra materials, labor, and services required to achieve this result shall be provided by the Contractor(s).

C. Replacement Materials:
   1. Materials that are damaged and not repairable, or materials that are destroyed shall be replaced with equal and identical materials of the same manufacture and shall function in conjunction with the remaining portions of that material. Items no longer manufactured or available shall be replaced with comparable materials as approved by the Architect and at no additional cost to the Owner.
   2. Materials that are required for maintenance replacement by the owner after the guarantee period has expired, or by the contractor during the guarantee period shall exactly match those materials installed as to make, style, color lot, etc., under this contract, and shall be delivered to the owner in marked, identified containers.

D. Extra Materials:
   1. Carefully examine the requirements of the applicable Sections of all DIVISIONS and specifically of DIVISION 09 and deliver the materials required to the Owner.

PART 3 - EXECUTION

3.1 REPAIR AND RESTORATION

A. All damaged items shall be repaired and replaced as directed using proper materials and craftsmen skilled in that particular trade. Materials shall be as follows:
   1. All repair or replacement parts shall be of the same equality and manufacturer as the item being repaired.
   2. All touch-up paint shall be as provided by the item manufacturer for that purpose and shall exactly match the original color and finish.

3.2 FIELD QUALITY CONTROL

A. Final Reviews:
   1. In addition to all items covered under those Sections of Divisions 02 through 49 inclusive, the Contractor shall comply with the requirements stated herein.
      a. The Contractor shall request in writing a final review (see Contractor's Request for Final Review form at the end of this Specification Section).
         1) The Contractor shall allow a forty-eight (48) hour time period of advance notification prior to the requested date and time indicated on the Review Request form.
         2) The Contractor represents that the work has been carefully inspected by the Contractor to determine that the work is complete and in compliance with all requirements set forth.
      b. The Contractor shall prepare and shall submit the initial Contractor's Punch List identifying the items that remain uncompleted forty-eight (48) hours prior to the scheduled final review by the Architect.
      c. Under no circumstances shall the Contractor ask the Architect or his representative to make these determinations for him.

2. The Architect shall review the initial Contractor's Punch List along with the Owner's Project Inspector, and determine together whether or not the Project is ready for final review. If approved, the Architect or its representative will make the final review on the date and time requested in the Contractor's Request for Final Review form, except under the following conditions:
    a. Upon reviewing a portion of the Project and finding quantities of work incomplete or not in compliance, the review shall cease, and the Architect will notify the Contractor.
    b. If the Contractor has assured the Architect of the completeness and/or accuracy of the work, and the review does not bear this contention out.
3. The above conditions will be adhered to rigidly to prevent the Architect from being required to act as a supervisory agent of the Contractor by being asked to determine the degree of completion,.
    a. When the Contractor requests additional reviews, he shall reimburse the Architect for all time and expense incurred as indicated on the Contractor's Request for Final Review form at the end of this Specification Section.
    b. The Architect is herein defined as any of those firms or individuals listed by references on the drawings, including all consultants identified herein.
    c. All requests for Project Final Review (and re-review) shall be made in writing on the form provided at the end of this Specification Section.
4. When the Architect does approve of the degree of readiness for the Project based on the initial Contractor's Punch List and the readiness of the Project, the Architect will make his final review, adding to the Contractor's Punch List any other items that require further completion.
5. The Contractor shall take the initial Contractor's Punch List, together with the Architect's Punch List, and initial and date each item on each list as to when it was completed.
6. Once both lists are completed and signed by the Project Inspector, the Contractor shall submit to the Architect the completed lists for final review and approval prior to filing for Substantial Completion.

3.3 CLEANING

A. During Construction:
1. Oversee cleaning and ensure that building and grounds are maintained free from accumulations of waste materials and rubbish.
2. Sprinkle dusty debris with water.
3. At reasonable intervals during progress of work, clean up site and access and dispose of waste materials, rubbish, and debris.
4. Provide suitable containers and locate on site for collection of waste materials, rubbish, and debris.
5. Do not allow waste materials, rubbish and debris to accumulate and become an unsightly or hazardous condition.
6. Remove waste materials, rubbish and debris form the site and legally dispose of at public or private dumping areas off the Owner's property.
7. Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for acceptance or occupancy.
8. Lower waste materials in a controlled manner with as few handling as possible; do not drop or throw materials from heights.
9. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

B. Final Cleaning:
1. Use experienced professional cleaners for final cleaning.

2. At completion of construction and just prior to acceptance or occupancy, conduct a final review of exposed interior and exterior surfaces.
3. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from interior and exterior surfaces.
4. Repair, patch, and touch-up marred surfaces to match adjacent finishes.
5. Broom clean paved surfaces; rake clean other surfaces of grounds.
6. Replace air conditioning filters if units were operated during construction.
7. Clean ducts, blowers, and coils if air conditioning units were operated during construction
8. Maintain cleaning until the building, or portion thereof, is accepted by the Owner.

3.4 DEMONSTRATION

A. During Construction and as each piece of equipment is installed, provide the following tests:
1. Verify that all external service connections have been properly completed, and that piping and/or wiring is properly sized, and contain all necessary safety devices.
2. Verify that the equipment is free of shipping materials, tie downs, or other internal obstructions.
3. Conduct tests employing the manufacturer's operating instructions as a sequential guide.
4. Verify that all portions of the equipment function properly and that the total performance criteria is satisfied.
5. Make adjustments, replacements, or repairs necessary to achieve full operational capability and repeat tests until performance is achieved and approval obtained.

B. Prior to acceptance, verify that all conditions specified in the Article titled FIELD QUALITY CONTROL, Final Review, have been satisfied and that equipment is ready for continuous use. Provide the following services preparatory to acceptance:
1. Clean or replace all filters and/or strainers.
2. Adjust all belts and drive mechanisms.
3. Lubricate all moving parts as required by manufacturer's operating instructions.
4. Demonstrate to the Owner's representative and the Architect or Engineer the method and sequence of operation, and provide testing devices and/or data to verify that performance equals that specified.
5. Provide operating instructions in bound form along with manufacturer's parts list and written warranties.

3.5 SCHEDULES

A. See next page for Request for Final Review from the Contractor(s):

(The rest of this page is left intentionally blank)

CONTRACTOR'S REQUEST
FOR
FINAL REVIEW FORM

PROJECT:_____
(Name of Project and DA Project Number)

TO: **DARDEN ARCHITECTS, INC.**
6790 N. West Avenue
FRESNO, CA 93711

FROM:_____
(Contractor)
_____
(Address)
_____

WE HEREBY request Final Review on _____ and _____.
(Date) (Time)

WE HEREBY, request and certify:

1. The project is ready for Final Review.
2. The undersigned will compensate the Architect at a rate of $176.00 an hour for further review, investigation and comments if it is determined that the Project is not ready for final review as indicated earlier within this Specification Section. The Architect is herein defined as any of those firms or individuals listed by reference on the Drawings, including all Consultants identified herein.

Submitted By (Contractor)

Signature_____
Firm_____
Address_____
Date_____
Telephone_____

Below is
for Use by Design Consultant only
___ Conditions for Final Review Accepted
___ Final Review Accepted as Noted
___ Final Review Not Accepted
By_____
Date_____
Remarks_____
_____
_____
_____

END OF SECTION

SECTION 01 78 36 – WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

A. In addition to providing all other warranties specified in the Project Manual and without affecting any rights of Owner under State or Federal law, Contractor shall warrant that the Work done under this Project Manual will be free from faulty materials or workmanship and hereby agrees, upon receiving notification from the Owner or his Agent, to immediately remedy, repair or replace, without cost to the Owners and to his entire satisfaction, all defects, damages or imperfections appearing in said work within a period of one (1) year unless specified otherwise, after date of final acceptance by the Owner of all work done under this Project Manual, regardless of whether or not the Owner or persons operating under contract with the Owner partially or wholly occupies any portion of the work prior to acceptance. For work performed after completion, the one (1) year period shall be extended by the period of time between the date of final acceptance by Owner and actual performance of the work. This obligation shall survive acceptance of the work and termination of the Contract.
   1. Warranties shall be in the form outlined below and shall be submitted in duplicate to the Contractor and submitted on his own letterhead.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 SUBMITTALS

Warranty Form: (following page.)

© Darden Architects, Inc.

(Contractor's Letterhead)
Project Number: _____
Project Name: _____

WARRANTY FOR

_____

We hereby warrant and the General Contractor warranties that

_____

_____

_____

has been done in accordance with the Drawings and the Specifications and that the Work as installed will fulfill the requirements of the warranty included in the Project Manual. We agree to repair, replace any or all of our work together with any other adjacent work which may be displaced or damaged by so doing that may prove to be defective in its workmanship or materials within a period of _____ years from date of acceptance of the above-named without any expense to the Owner, ordinary wear and tear and unusual abuse or neglect excepted. In the event of our failure to comply with above-mentioned conditions within ten (10) days after being notified in writing by the Owner or his agent, we collectively or separately, do hereby authorize the Owner to proceed to have said defects repaired and made good at our expense and we will honor and pay the costs and charges therefor upon demand.

_____
(Signature of Subcontractor)

_____
(Signature of Contractor)

Date: _____

A. Submit 2 copies of all manufacturer's or installer/applicator's warranties and bonds as specified within Division 02 –49.
B. Submit to Architect together with Project Record Documents.
C. Accompany submittals with transmittal letter in duplicate.
D. When Product Submittals are required, submit copy of warranty with product submittal.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION - NOT APPLICABLE

END OF SECTION

SECTION 01 78 39 – PROJECT DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the administrative and procedural requirements for Project Record Documents, including the following:
   1. Project As-Built Drawings.
   2. Project Record Drawings.
   3. Record Specifications.
   4. Record Product Data.

B. Related Requirements: The following Project Manual Sections contain requirements that relate to this Section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.3 DEFINITIONS

A. CONTRACT DOCUMENTS: Contract Documents include Contract Forms, Project Manual (Contract Requirements and Specifications), Drawings, Addenda, Change Orders and Modification Documents (Supplemental Instructions, Request for Information, Construction Change Directives).

B. PROJECT "AS-BUILT" DOCUMENTS: A set of Contract Documents used during construction for recording of actual construction information during construction. The recording of construction information shall be maintained on the Contract Drawings and in the Project Manual.

C. PROJECT "RECORD" DOCUMENTS: A set of Contract Documents used at the completion of construction for transferring and documenting the actual construction information recorded on the PROJECT "AS-BUILT" DOCUMENTS.

D. RECORD PRODUCT DATA: A set of Submittals and Shop Drawings that have documentation of field changes made after review.

E. AGENCY DOCUMENTATION: Documents required by the Agency Having Jurisdiction to be prepared and submitted by the contractor.

1.4 SUBMITTALS:

A. Submit the following in accordance with specification Section SUBMITTAL PROCEDURES.

B. Format for Submittals:
   1. Accompany each submittal with a SHOP DRAWING AND SUBMITTAL TRANSMITTAL:
   2. PDF electronic file names shall match the Sheet Numbers of the Contract Documents.
   3. Provide labels on DVD's and DVD Cases and include the following:
   4. First Line: CLOSE-OUT DOCUMENTS
   5. If submittal contains multiple disks append to first line Disk, i.e. (1 of 2)
   6. Second Line: Project Name and Year

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7. Third Line: Architect Firm Name and Architect's Project Number
8. Fourth Line: DSA or HCAI Number (if applicable)
9. Fifth Line: Contractor Company Name
10. PDF files for Project "Record" Documents and Record Product Data shall be combined with PROJECT CLOSEOUT, Maintenance Data and Operations Data, and WARRANTIES on a single set of DVD's.

C. PROJECT "AS-BUILT" DOCUMENTS: Comply with the following:
1. Number of Copies: Submit one paper-copy set of marked-up as-built drawings and one paper-copy of marked-up as-built specifications.
2. Clearly Label each copy "PROJECT 'AS BUILT' DOCUMENTS" in two-inch-high printed letters.

D. PROJECT "RECORD" DOCUMENTS: Comply with the following:
1. Number of copies: Submit copies of the Record Documents as follows:
a. Initial Submittal:
1) Submit one paper-copy of marked-up record drawings and one paper copy of marked-up record specifications,
2) Alternatively, submit PDF electronic files of scanned marked-up record drawings and marked-up record specifications on one set of DVD's
3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
2. Final Submittal:
3. Submit one paper-copy of marked-up record drawings, one paper copy of marked-up record specifications, and PDF electronic files of scanned marked-up record drawings and marked-up record specifications on three sets of DVD's.
4. Each record drawing sheet shall be labeled, "PROJECT "RECORD" DOCUMENT.•
5. Print each drawing, whether or not changes and additional information were recorded.
6. Clearly Label each copy "PROJECT "RECORD" DOCUMENTS in two-inch-high printed letters in a prominent location.

E. RECORD PRODUCT DATA: Comply with the following:
1. Number of Copies:
a. Submit one paper-copy set of marked-up shop drawings.
b. Submit three DVD's of PDF electronic files of scanned marked-up shop drawings.

F. AGENCY DOCUMENTATION: Comply with the following:
1. Submit Documentation Required by the Agency Having Jurisdiction utilizing the format and system established by the Agency.

1.5 SYSTEM DESCRIPTION

A. The Architect considers the Project Record Documents to be of significant importance to the Owner.

B. Project Record Documents provide important information for the Owner's records, they form an invaluable record for future reference for concealed conditions, facilities management processes, and future additions and renovations.

PART 2 - PRODUCTS

2.1 General:

A. All costs (including the time) required for recording, transferring, and copying all documentation shall be part of the Contractor's Overhead Expense.

B. Provide red pencil or ink (contrasting color) for all marking of the PROJECT "AS-BUILT DOCUMENTS, PROJECT "RECORD" DOCUMENTS, and RECORD PROJECT DATA.

C. Do not permanently conceal any work until required information has been recorded.

2.2 RECORD DRAWINGS

A. PROJECT "AS-BUILT" DOCUMENTS: Maintain one set of marked-up paper copies of the Contract Drawings: and Specifications, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
2. Content: Types of items requiring marking include, but are not limited to, the following:
    a. Elevation for finish grade for all points indicated on Site Grading Plan.
    b. Depths of various elements of foundation in relation to first floor finish elevation.
    c. Horizontal and vertical location of underground utilities and appurtenances referenced to visible and accessible features of structure.
    d. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities Field changes of dimensions and details.
    j. Changes made by Addenda, Change Orders and other Modification Documents.
    k. Details not on original Contract Documents.
    l. Changes made on Shop Drawings.
3. Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
    a. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
    b. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
    c. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
    d. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
    e. Note related Changes Orders, record Product Data, and record Drawings where applicable.
4. Mark the Contract Drawings and Specifications completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
5. Note Request for Information numbers, Supplemental Instruction numbers, Construction Change Directive numbers, Change Order numbers, and similar identification, where applicable.

2.3 PROJECT "RECORD" DOCUMENTS:

A. General: Transfer all changes, notations, etc. from the "AS-BUILT" PROJECT DOCUMENTS to the "PROJECT RECORD" DOCUMENTS in the same quality as the original Contract Documents.

2.4 RECORD PRODUCT DATA

A. Maintain one set of marked-up paper copies of the Shop Drawings and Product Data, incorporating any modifications to the reviewed documents.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders and record Drawings where applicable.
4. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.5 AGENCY DOCUMENTATION

A. Contractor shall prepare and upload all applicable forms pertaining to the Contractor as required by the Division of State Architect DSA Procedure 13-02, including but not limited to:

1. DSA 6-C - Contractor Verified Report.
2. NFPA System Record of Completion.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE:

A. Recording:

1. Keep all documents current, PROJECT "AS-BUILT" DOCUMENTS shall be kept current at all times. Post changes and revisions to project as-built documents as they occur; do not wait until end of Project.
2. The Project Inspector will review the PROJECT "AS-BUILT" DOCUMENTS periodically for the Architect at the time Payment Requests are processed. Should the PROJECT "AS-BUILT DOCUMENTS not be current and up to date, the Owner reserves the right to hold the Payment Request until compliance with the Contract Documents has occurred.

B. Maintenance of Documents:

1. Maintain at job site the following:
   a. Contract Drawings.
   b. Project Manual/Specifications.
   c. Addenda.
   d. Reviewed shop drawings.
   e. Change Orders.
   f. All Modification Documents.
   g. Field test records.
2. Store documents in field office apart from documents used for construction.
3. Provide files and racks for storage of documents.
4. File documents in accordance with Project Filing Format or Uniform Construction Index.
5. Maintain documents in clean, dry, legible condition.
6. Do not use record documents for construction purposes.

7. Make documents available at all times for inspection by Architect, Owner and Owner's Inspector.

END OF SECTION

SECTION 02 26 00 – HAZARDOUS MATERIALS PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to provide Hazardous Materials Procedures, accessories and other related items necessary to complete the Project as indicated by the Owner provided Testing Reports and Abatement Procedures.
      a. Refer to the Appendix that contains Testing Reports and Abatement Procedures for materials, location, and scope of the Work.
   2. Testing Reports and Abatement Procedures have been prepared by the Owner and incorporated into the Project Manual. The Architect and Architect's consultants have no responsibility for the discovery, presence, handling, removal or disposal of or exposure of persons to hazardous materials in any form at the Project Site.
      a. The Contractor and all subcontractors shall agree to bring no claim for negligence, breach of contract, indemnity or otherwise against the Architect (principals and employees), agents and consultants if such claim in any way involves or is related to any hazardous materials in the Project.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 09 65 19 RESILIENT TILE
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with the following standards:
      a. CAL-OSHA California Occupational Safety and Health Act.
      b. DOSH Department of Occupational Safety and Health.
      c. EPA Environmental Protection Agency

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Quality Assurance/Control Submittals:
      a. Provide to the Owner the following requirements:
         1) Provide a copy of California Contractor License, and current registration with CAL-OSHA (DOSH) for Asbestos related roof work.
         2) Hazardous Material Removal Subcontractor shall provide proof of Workers Compensation, General Liability ($1,000,000.00 minimum), and professional liability Insurance Certificates which specifically state the insurance will cover Asbestos Abatement.

2. Pre-Construction Requirements – submittal to the Owner's Representative prior to construction:
    a. CAL-OSHA Plan of Action per DOSH Registration.
    b. Illness and Injury Prevention Program.
    c. Code of Safe Working Practice.
    d. Hazard Communication Program.
    e. List of Hazardous Materials Your Company uses.
    f. Material Safety Data Sheets (MSDS) of All Material required for Project.
    g. Copy of Project Notices to CAL-OSHA and County EPA office. Post all information at the Project Site.
    h. Copy of all CAL-OSHA and EPA Citations, (if any) for Asbestos removal during the last 24 months.
3. Closeout Submittals in accordance with the following:
    a. Project Completion Documentation - submittal to the Owner's Representative prior to final approval:
        1) Daily Air Monitoring reports.
        2) Dump Receipts and Notaries Letters.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Hazardous Material Removal Subcontractor's Qualifications:
    a. Engage an experienced Hazardous Material Removal Subcontractor who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    a. Other applicable City, County, State and Federal Requirements where the Project is located.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide all materials as required to complete the work as indicated by the Owner's Testing Reports and Abatement Procedures.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.

3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
   2. Contractors shall cooperate with other contractors and the Owner in the use of the site facilities and shall adjust their operations to maintain harmonious relations and uninterrupted progress of the Work.

B. Protection:
   1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
   2. Install and maintain shelter as may be necessary to protect completed Work and existing structures from damage and disfigurement by the elements and other natural causes.
      a. Any portion of Work (or existing facilities) damaged or disfigured prior to final acceptance of the abatement, shall be properly, neatly and satisfactorily reconstructed or repaired and the Project left without defects at final acceptance.

3.3 FIELD QUALITY CONTROL

A. Provide the Owner's Representative (prior to final acceptance) the following:
   1. Provide copies of Daily Air Monitoring of both personal and work areas, completed and tested by an Independent Testing Laboratory.
   2. Provide copies of Dump Receipts and Notaries Letter confirming site and amount of debris dumped.
      a. Burning of combustible materials from demolished work will not be permitted on site.
      b. Transport materials removed from the work and dispose of off site at legally designated hazardous material dumps.

3.4 CLEANING

A. The Contractor shall at all times keep the premises free from accumulations of waste materials or rubbish caused by its employees or Work, and at the completion of the Work the Contractor shall remove all rubbish from and about the building and all tools, scaffolding and surplus materials and shall leave work "broom clean" (or its equivalent), or in accordance with code requirements (which ever is most restrictive).

END OF SECTION

SECTION 03 11 01 – CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all Concrete Formwork materials, and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 03 15 14 DRILLED ANCHORS
   4. 03 20 00 REINFORCEMENT
   5. 03 30 00 CAST-IN-PLACE CONCRETE
   6. 03 35 00 POLISHED CONCRETE FINISHING
   7. 04 22 00 CONCRETE MASONRY UNITS
   8. 05 12 00 STEEL AND FABRICATIONS
   9. 06 10 00 ROUGH CARPENTRY
   10. 07 40 00 METAL PANELS
   11. 07 92 00 SEALANTS
   12. 31 20 00 EARTHWORK
   13. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   14. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with the latest edition of the following standards:
      a. ACI American Concrete Institute
      b. APA The Engineered Wood Association (formerly the American Plywood Association)
      c. PS Product Standards of the U.S. Department of Commerce, latest edition
      d. WCLIB West Coast Lumber Inspection Bureau

1.3 DEFINITIONS

A. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

B. Unexposed: concealed surface.

C. Exposed: exposed surface.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product Data.
      a. Forming materials.
      b. Tie rods and spreaders.
      c. Formwork for exposed concrete.
      d. Form coatings and release agents.
   2. Shop Drawings:

a. The Contractor shall submit drawings showing the proposed form tie locations for exposed form indentations.

3. Samples.
   a. Form liners for specific finished concrete surfaces.
4. Quality Assurance/Control Submittals:
   a. Manufacturer's written Instructions:
      1) Instructions for specific form liner manufacturer indicated.
5. Closeout Submittals:
   a. Record Documents in accordance with Specification Section – PROJECT DOCUMENTS.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
   2. Manufacturer/Supplier Qualifications:
      a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the Work.

B. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS.

C. Mockups:
   1. Cast in accordance with Specification Section – CAST-IN-PLACE CONCRETE, Part 1 Article titled "SUBMITTALS," paragraph titled "Mockups" for requirements.
      a. Provide with all applicable joints, grooves, textures, etc.

1.6 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written standard warranty:
      a. Warranty Period: One (1) Year.

C. Installer's Warranty:
   1. In accordance with the terms of the Specification Section - WARRANTIES.
      a. Warranty Period: One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 UNEXPOSED FINISH FORMS

A. Provide plywood, lumber, or another acceptable material.

1. Lumber shall be dressed on at least two edges and one side for tight fit, complying with WCLIB Standard Grading and Dressing Rules #17, for Douglas Fir Form Lumber.
2. When plywood is used, provide panels complying with PS1, B-B (Concrete Form) Plywood, Group 1, EXT-APA mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

2.3 EXPOSED FINISH FORMS

A. Provide plywood panel type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practical sizes to minimize number of joints and to conform to joint system shown on the drawings.

1. Single Pour Forms: Provide liner panels that are complying with PS1, MDO Plywood, B-B, Group 1, EXT-APA, mill-oiled, edge-sealed, with each piece bearing legible inspection trademark, which are limited to "single-pour use" forms, that are manufactured by SIMPSON TIMBER PRODUCTS, or approved equivalent.
2. Multiple Pour Forms: Provide HDO Plywood "Multipour" liner panels, which are limited to "double-pour use" forms, that are manufactured by SIMPSON TIMBER PRODUCTS, or approved equivalent.

2.4 CIRCULAR COLUMN FORMS

1. All circular concrete columns identified on the drawings shall be formed with "Spiral Seam" SONOTUBE Fiber Forms, as manufactured by SONOCO PRODUCTS COMPANY, or approved equivalent.

2.5 PERMANENT FORMS

A. Abandoned in place:

1. Provide forms for concrete pan-type construction with covers and closures.
2. Forms designed to be left in place, shall be metal or fiberglass pan forms that will not be subject to moisture damage or decay.
3. Provide standard or tapered end forms if required to create shapes indicated.
    a. Manufacturer: MOLDED FIBERGLASS FORM COMPANY.

2.6 NON-COMPRESSIVE HIGH DENSITY FOAM FILL

A. Foam-Control Geofoam, EPS19, complying with ASTM D 6817 "Standard Specification for Rigid Cellular Polystyrene Geofoam", with the following physical characteristics:

1. Density, min., kg/m^3: 18.4.
2. Compressive Resistance, @ 1 percent deformation, min., psi: 40.0.
3. Flexural Strength min., psi: 207.0.
4. Oxygen index, min., volume percent: 24.0.

B. Accessories: Provide all adhesives, "geogripper" plates, etc. to comply with manufacturer's written installation instructions for a complete and functional installation.

2.7 ACCESSORIES

A. Cement Compound Plugs:

1. Provide gray colored cement compound plugs ("SnaPlug" by MEADOW / BURKE, or approved equivalent) in highly visible concrete surface areas.
    a. Provide "flush type" in cone holes of size appropriate to the hole size created by tie-holes.
2. Provide a waterproof neoprene adhesive ("SnaPlug Bonder" by MEADOW / BURKE, or approved equivalent), resistant to weather aging and bacterial growth, for adhering cement compound plugs into cone holes.

B. Chamfer Strips:

1. Provide wood chamfer strips free of knots, for forming edges of cast-in-place concrete.

C. Double Sided Foam Tape: Provide "Scotch" double sided, high density, pressure sensitive adhesive, foam tape as manufactured by The Tape Division of 3M PRODUCTS, INC., or approved equivalent.

D. Form release agent:
   1. Provide commercial formulation form release agent with a maximum volatile organic compounds (VOC's) in compliance with the CARB in the area where the project is located, that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   2. Provide form liner manufacturer's form release agent when a particular form liner is used to maintain compatibility with form release agent and the form liners used for this project.

E. Rustication Strips:
   1. Provide wood rustication strips free of knots, for forming straight continuous reveals (either vertically or horizontally) and PVC rustication strips as manufactured by MEADOW / BURKE, for forming curved continuous reveals (either vertically or horizontally).

F. Spreaders and ties for loose plywood forming:
   1. Spreader Ties: Use metal spreaders and ties for surfaces to be sacked. Use type that will give positive tying and accurate spreading for accurate sizing of cast walls or forms. Snap type shall leave no metal closer than 1-1/2 inches from exposed surface of concrete and have spreader cones no larger than 1 inch diameter. MEADOW / BURKE COMPANY.

G. Nailer Strip:
   1. Provide decay resistant pressure treated wood nailer strips of sizes and locations indicated on the drawings.
      a. For roof systems, provide compatible materials with the roof system manufacturer's applications.
      b. Provide fire retardant pressure treated wood nailer strips when the roof assembly requires a Class A rating.
   2. All pressure treated wood (decay or fire-retardant) shall be in accordance with the applicable standards of the AWPA as referenced in the Specification Section - ROUGH CARPENTRY.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface preparation:
   1. Consult with other Trades relative to required openings, and items to be embedded in concrete (i.e., piping, conduit, hangers, reglets, anchors, inserts, sleeves, etc.). Coordinate work specified under other sections to ensure proper, adequate interfacing between trades, for openings, chases, blockouts, and other required interfacing items.

3.2 ERECTION

A. All formwork shall be:
   1. Designed and constructed in accordance with ACI Standard 347 "Recommended Practice for Concrete Formwork."
      a. Follow ACI 303R "Guide to Cast-In-Place Architectural Concrete" for further recommendations in design and use of Patterned Form Liners.
   2. Construct to size, shape, alignment, elevation and position of all concrete elements.
      a. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features required in the work. Use selected materials to obtain required finishes.

b. Orient circular fiberglass forms so that the seam is always facing the nearest adjacent wall, or an obscure side not highly visible. Contact the Architect for conditions not easily determined.

3. Properly separate and securely tie with Spreaders and Ties to maintain proper shape. Wood spreaders shall not be allowed to remain in concrete work.
   a. Use "Penta-Ties" where indicated on the drawings. Glue in cement compound plugs.
4. Brace, support and center sufficiently to carry without excessive deflection all live and dead loads imposed during construction and placement of concrete, and to insure safety to workers and passersby.
   a. Block adjoining permanent pan units left in place to prevent lateral deflection of forms while placing concrete.
5. Properly construct to eliminate all open joints or discontinuous surfaces.
   a. Solidly butt joints with double sided foam tape, apply silicone sealant at concrete face, and provide backup at joints to prevent cement paste or mortar from leaking.

B. All joints shall be:
1. Uniform and backed by 2 inch material.
2. Continuous and level or plumb.
3. Sufficiently tight (with double sided foam tape and silicone sealant) to prevent leakage of cement paste.
   a. Locate joints of formwork whenever possible at rustication joints.
4. Subject to Architect's approval.

3.3 INSTALLATION

A. General: Design, engineer, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position.
1. Access Openings: Shall be provided in forms for cleaning and inspection of forms and reinforcement.
   a. In Wall Forms: Provide openings for each pour, composed of a form section held out until inside of each formed cavity has been cleaned, so that no "access hole" is visible in the finished concrete surface.
   b. In Column Forms: Provide openings for each pour, composed of a form section held out until inside of each formed cavity has been cleaned, so that no "access hole" is visible in the finished concrete surface.
      1) Clean out forms prior to placement.
      2) Protect positioned forms prior to pouring from being damaged by rain or snow.
      3) Place a block under the form so that it does not stand in water or snow. Remove block and reposition form prior to pouring.
      4) Clean out forms prior to pumping concrete.
      5) Forms (according to manufacturer's written recommendations) shall not be left on the columns for longer than five days.
      6) Remove the form in accordance with manufacturer's written recommendations without damaging the poured column finish.
      7) If columns are stripped prior to the completion of the project, take steps to protect from damage. Replace the form halves on the stripped column and secure with wire.
2. Architectural Concrete elements shall be formed with MDO (or HDO) form plywood where face uniformity is required such as on signs, plaques, kiosks, and landscape elements.

3. Side forms at unexposed footings may be omitted if excavation stands without caving.
   a. Make footing trench two (2) inches wider than width of concrete footing indicated on the drawings, when earth is used as a form.
   b. Cut trenches true and straight.
   c. Make side cuts neat and plumb.
   d. Bottom of trenches shall be level with reasonably sharp corners.
4. Formwork above grade (stairs, curbs, exposed faces of concrete foundations, etc.) shall be:
   a. Plywood type as specified treated with Sealer.
   b. Constructed with plumb and level joints.
   c. Separated with removable or snap type Spreaders and Ties. Do not use wire ties.
5. Unintentional indentations in the surface of the concrete left after removal of spreaders and ties shall be filled and sacked unless the architect's approval is given to do otherwise.
   a. Install Cement Compound Plugs where exposed form tie indentations occur.
6. Sleeves, anchors and bolts, angles, supports, ties and other materials in connection with concrete construction shall be secured in position before the concrete is placed.

3.4 CONSTRUCTION

A. Special Techniques – Form Removal and Reuse of Forms:
   1. All forms shall be completely removed.
   2. Time of Removal shall be in accordance with ACI 301 "Specifications for Structural Concrete," which requires concrete to reach its specified compressive strength. Variations to the time of removal are listed below subject to the concrete reaching its specified compressive strength:
      a. Dependent on weather conditions.
         1) Due to excessive cold weather for a long duration of days, and subject to the Architect's approval, the time for removal may be extended if deemed necessary.
      b. Dependent on cylinder test results.
      c. Dependent on recommendations of additive manufacturer when additives are admitted to the mix.
      d. Typically (verify with three statements above before initiating the following):
         1) Foundation Side Forms: Five (5) days after concrete is poured.
         2) Wall Forms: Ten (10) day after concrete is poured.
         3) Column Forms: Ten (10) days after concrete is poured.
         4) Beam, Slab and Joist Soffit Forms:
            a) Twenty-One (21) days after concrete is poured.
            b) Re-shore as required to support dead loads and any construction loads applied.
      e. Remove forms in a manner that will not harm concrete. Do not hammer or pry against concrete.
   3. Nails, tie wires and form ties shall be cut off flush with face of concrete.
   4. Snap type spreaders to be snapped off inside the wall surface.
   5. Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release compound as specified for new formwork.
   6. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to the Architect.

B. Site Tolerances:

1. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 "Guide to Formwork for Concrete" limits:
   a. Provide Class A tolerances (permitted irregularities are 1/8" in 10' for both gradual and abrupt) for all concrete surfaces exposed to view, or surfaces that will receive additional applied finishes.
2. Concrete work out of alignment, or level or plumb exceeding the allowable tolerance will be cause for rejection of the whole work affected. Such work shall be removed and replaced as directed by Architect with no additional cost to Owner.

3.5 CLEANING

A. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Re tighten forms and bracing before placing concrete, as required, to prevent leakage of cement paste and maintain alignment.

B. Remove all wood used for formwork from trenches. No wood shall be left buried in the earth.

C. Final cleaning shall be in accordance with Specification Section – PROJECT CLOSEOUT.

END OF SECTION

SECTION 03 15 14 – DRILLED ANCHORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all Drilled Anchor materials, labor, equipment and services necessary for Expansion, Adhesive, and Screw Anchors in Concrete, and Concrete Masonry Units, and related items necessary to complete the Project as indicated by the Contract Documents unless otherwise specifically excluded.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 03 11 01 CONCRETE FORMWORK
   4. 03 20 00 REINFORCEMENT
   5. 03 30 00 CAST-IN-PLACE CONCRETE
   6. 04 22 00 CONCRETE MASONRY UNITS
   7. 05 12 00 STEEL AND FABRICATIONS
   8. 05 30 00 METAL DECK
   9. 06 10 00 ROUGH CARPENTRY
   10. 06 41 23 MODULAR CASEWORK
   11. 09 22 16 METAL FRAMING
   12. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   13. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product Data.
      a. Submit manufacturer's product data for all expansion and adhesive anchors to be used in this project.
         1) Submit current ICC Evaluation Services research or evaluation reports evidencing maximum allowable shear and withdrawal load data.
   2. Quality Assurance / Control Submittals:
      a. Test Reports: Submit to DSA, copy to Project Inspector and Contractor.
         1) Tension Testing as required.

1.3 QUALITY ASSURANCE

A. Single Source Responsibility:
   1. To ensure consistent quality of anchorage, obtain drilled anchors from a single manufacturer.
   2. To ensure consistency of anchorage, obtain adhesive for anchorage from a single manufacturer.

B. Manufacturer Qualifications: Provide drilled and adhesive anchors from a manufacturer that can demonstrate ICC approvals that are current and acceptable to review by the DSA/SS.

C. In accordance with Specification Section - REGULATORY REQUIREMENTS and the following:
   1. ICC International Code Council.
   2. IR Interpretation of Regulations.

D. Job Testing: For verifying satisfactory installation workmanship, an independent laboratory will perform proof load tests of drilled anchors acting in tension or shear in the presence of the Project Inspector.
   1. When drilled-in expansion-type anchors or other post-installed anchors acceptable to the enforcement agency are used in lieu of cast-in-place bolts, the allowable shear and tension values and installation verification test loads shall be acceptable to the enforcement agency.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in original, unopened packages with manufacturer's labels identifying products legible and intact.

B. Store materials inside, under cover and in a manner to keep them dry, protected from the weather, surface contamination, corrosion, damage from construction traffic and other causes.

1.5 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written standard warranty:
      a. Warranty Period: One (1) Year.

C. Installer's Warranty:
   1. In accordance with the terms of the Specification Section - WARRANTIES.
      a. Warranty Period: One (1) Year.

PART 2 - PRODUCTS

2.1 GENERAL

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Provide manufacturers standard drilled anchors (expansion or adhesive) for installation into Concrete or Concrete Masonry Units unless noted otherwise.
   1. Metal Finishes (corrosion resistant):
      a. Zinc Plated Carbon Steel.
      b. Stainless Steel.

2.3 EXPANSION ANCHORS:

A. Specified product manufacturer: HILTI INC.
   1. Acceptable alternative manufacturer, subject to compliance with requirements:
      a. DEWALT/POWERS.
      b. SIMPSON.

B. Wedge Anchors: The WEDGE category features a small split expansion ring installed on a tapered (integral cone) part of the stud at the bottom. As the nut is tightened, withdrawing the

stud portion from the hole, the expansion ring engages the concrete and is further expanded on the tapered part of the stud.

C. Sleeve Anchors: The SLEEVE category is similar to the wedge except a large expansion sleeve is used instead of a small expansion ring. The outside of the sleeve defines the anchor diameter with the threaded stud being of a smaller diameter since it fits inside the sleeve. The stud has an integral cone expander at the bottom similar to the wedge category. The expansion mechanism is similar to the wedge category except the top of the sleeve is normally in contact with the nut/washer and is initially forced down over the cone expander as the anchor is tightened. As the sleeve is expanded, it engages the concrete and continues to expand as the wedge anchor.

D. Shell Anchors: The SHELL category has the most variations, but all use a tapered cone expander, either internal or external, to expand the shell of the anchor against the hole. The anchor is either hammered down over an external expander or a special tool is used to drive an internal expander further into the anchor.

2.4 ADHESIVE ANCHORS

A. Specified product manufacturer: HILTI INC.
   1. Acceptable alternative manufacturer, subject to compliance with requirements:
      a. DEWALT/POWERS.
      b. SIMPSON.

B. Adhesive Anchors which chemically bonds Steel Rods or Deformed Steel Reinforcement Dowels to concrete or masonry elements:
   1. Threaded Steel Rods with minimum yield strength of 36 ksi and complying with ASTM A36 "Specification for Carbon Structural Steel," or ASTM A193 "Specification for Alloy-Steel and Stainless Steel Building Materials for High Temperature or High Pressure Service and Other Special Purpose Applications," Grade B7.
   2. Deformed Steel Reinforcement Dowels shall be a minimum of Grade 60 and comply with ASTM A615 "Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement" or ASTM A706 "Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement."
   3. Adhesives, consisting of two primary components that are stored separately, and having a mixing nozzle provided by the manufacturer combining the components prior to placing in the holes.
   4. Long term durability and stability of the adhesive anchor material and its resistance to loss of strength and chemical change at elevated temperatures shall be established to the satisfaction of the enforcement agency.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordination:
   1. Coordinate and provide anchors and installation instructions from the manufacturer for items to be embedded in Concrete or Concrete Masonry Unit construction. Manufacturer's written installation instructions shall be available on the project site.

3.2 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices where necessary for securing designated items indicated on the drawings, or as necessary for a complete and proper job to in-place construction.
   1. Install the anchors in accordance with the requirements given in the ICC Evaluations Services Report recommendations for the specific anchor used.
   2. Install Adhesive Anchors by placing adhesive into specially prepared holes, then insert rods or dowels into holes in a manner that disperses the adhesive to assure maximum contact between adhesive, surface of the holes and surface of the anchor.

a. Adhesive anchors shall not be used in overhead applications.

B. Cutting, Fitting, and Placement: Perform cutting, drilling and fitting required for designated items of construction. Set work accurately in location, alignment and elevation, level true and free of rack, measured from established lines and levels.

1. The minimum edge distance and spacing of wedge and adhesive anchors shall not be less than ten (10) diameters or as required by ICC Evaluation Service Report unless specifically shown on drawings.

C. Use care and caution to avoid cutting or damaging reinforcing bars in Reinforced Concrete or Concrete Masonry Construction.

D. Do not install expansion or adhesive anchors in recently placed concrete which has not had a minimum 28 day curing period and which has not been accepted as having a minimum compressive strength of 3000 psi.

3.3 FIELD QUALITY CONTROL

A. Testing, General:

1. Perform testing in accordance with ACI 318 "Building code Requirements for Structural Concrete and Commentary, CBC Section 1910A.5" and herein specified.
   a. When expansion or adhesive anchors are listed for sill plate bolting applications, 10 percent of the anchors shall be tested.
   b. When expansion or adhesive anchors are used for other structural applications, all such anchors shall be tested.
      1) Expansion-type anchors shall not be used as hold-down bolts.
   c. When expansion or adhesive anchors are used for nonstructural applications such as equipment anchorage, 50 percent or alternate bolts in a group shall be tested, except that if the design load is less than 75 pounds, only one anchor in ten need be tested. See drawings for items weighing 75 pounds or less.
      1) The testing of the anchors shall be done in the presence of the Project Inspector and a report of the test results shall be submitted to the enforcement agency.
2. When expansion anchors are used for ceiling hanger wires, 1 out of 10 must be field tested for 200 pounds of tension per IR 25-2.
   a. When expansion anchors are used for ceiling bracing wires, 1 out of 2 must be field tested for 440 pounds in tension.
   b. Test ceiling anchors with wires attached.
3. The proof load may be applied by any method that will effectively measure the tension in the anchor, such as direct pull with a hydraulic jack, calibrated spring-loading devices, etc.
4. If any anchor fails testing, test all anchors of the same category not previously tested until twenty (20) consecutive pass, then resume the initial testing frequency.
   a. The cost of any additional testing as a result of failures shall be the responsibility of the Contractor at no additional cost to the Owner.
5. When a drilled-in adhesive anchor is used in lieu of a required cast-in-place bolt, cost of testing shall be the responsibility of the Contractor at no additional cost to the Owner.

B. Testing:

1. Expansion Anchors:
   a. Anchor diameter refers to the thread size for the WEDGE & SHELL categories, and to the anchor outside diameter for the SLEEVE category and Adhesive anchors.
   b. Apply proof test loads to WEDGE & SLEEVE anchors without removing the nut if possible. If not, remove nut & install a threaded coupler to the same tightness of the original nut using a torque wrench & apply load.

c. For SLEEVE/SHELL internally threaded categories, verify that the anchor is not prevented from withdrawing by a baseplate or other fixtures. If restraint is found, loosen and shim or remove fixture(s) prior to testing.

d. Reaction loads from test fixtures may be applied close to the anchor being tested, provided the anchor is not restrained from withdrawing by the fixture(s).

e. SHELL type anchors shall be tested as follows:

1) Visually inspect 25 percent for full expansion as evidenced by the location of the expansion plug in the anchor body.

a) Plug location of a fully expanded anchor shall be as recommended by the manufacturer, or, in the absence of such compensation, as determined on the job site following the manufacturer's written installation instructions.

b) At least 5 percent of the anchors shall be proof loaded as indicated in the Test Values schedule on the drawings, but not less than three anchors per day for each different person or crew installing anchors. or;

c) Test installed anchors per ACI 318 "Building code Requirements for Structural Concrete and Commentary."

2. Adhesive Anchors:

a. Adhesive anchors shall be tension tested. The tension test load shall equal one and one-quarter (11/4) times the maximum design strength of the anchor as determined in compliance with ACI 318 Chapter 17 and the anchors evaluation report, or 80 percent of the yield strength of the bolt (0.8AbFy), whichever is less.

1) The test procedure for expansion-type anchors in the test values table shall also be used for the adhesive anchors.

b. Where adhesive anchors are used as shear dowels across cold joints in slabs-on-grade and the slab is not part of the structural system, testing of those dowels is not required.

c. Anchors shall exhibit no discernible movement during the tension test.

3. Test equipment (including torque wrenches) is to be calibrated by an approved testing laboratory in accordance with standard recognized procedures.

a. Alternate torque test procedures and test values for SHELL type anchors may be submitted to the enforcement agency for review and approval on a case-by-case basis when test procedures are submitted and approved by the enforcement agency.

4. The following criteria apply for the acceptance of installed anchors:

a. HYDRAULIC RAM METHOD: The anchor should have no observable movement at the applicable test load[. For wedge and sleeve type anchors, a practical way to determine observable movement is that the washer under the nut becomes loose].

b. TORQUE WRENCH METHOD: The applicable test torque must be reached within the following limits:

1) Wedge or Sleeve Type: One-half (1/2) turn of the nut.

a) One-quarter (1/4) turn of the nut for the 3/8 inch sleeve anchor only.

2) Torque testing of adhesive anchors is not permitted.

5. If the manufacturer's recommended installation torque is less than the test torque note in the table, the manufacturer's recommended installation torque shall be used in lieu of the tabulated values.

6. Testing should occur 24 hours minimum after installation of the subject anchors.

7. Required Maximum Test Values for Concrete, or Concrete Masonry Units in tension for the ranges and sizes of Drilled Anchors are shown on the drawings.

END OF SECTION

SECTION 03 20 00 – REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all reinforcement material, labor, equipment and services necessary to completely install all reinforcing materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 11 01 CONCRETE FORMWORK
4. 03 15 14 DRILLED ANCHORS
5. 03 30 00 CAST-IN-PLACE CONCRETE
6. 04 22 00 CONCRETE MASONRY UNITS
7. 05 12 00 STEEL AND FABRICATIONS
8. 31 20 00 EARTHWORK
9. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
10. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 REFERENCES

A. The following References and Manufacturer's Standards shall apply to this Specification Section:

1. ACI American Concrete Institute
2. ASTM American Society for Testing and Materials
3. AWS American Welding Society
4. CRSI Concrete Reinforcing Steel Institute

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Product Data:
    a. Manufacturer's specification and installation instructions for splice devices.
        1) Bar supports.
2. Shop Drawings
    a. Detail in accordance with ACI 315 "Details and Detailing of Concrete Reinforcing."
    b. Indicate bending diagrams, assembly diagrams, splicing and laps of bars and shapes, dimensions and details of bar reinforcing and assemblies. Correctness of all reinforcing requirements and work is the responsibility of Contractor. Identify such shop drawings with reference thereon to sheet and detail numbers from Contract Drawings.
        1) Do not use scaled dimensions from Contract Drawings in determining the lengths of reinforcing bars.
        2) No reinforcing steel shall be fabricated without approved shop drawings.
        3) One of the required submittal copies shall be reproducible transparency.
        4) Any deviations from the contract documents must be clearly indicated as a deviation on the shop drawings.

5) Areas of high congestion, including member joints and embed locations shall be fully detailed to verify clearances and assembly parameters and coordination with other trades.

c. Certificates of Compliance with specified standards:

1) Reinforcing Bars.

2) Welded wire fabric.

3) Welding electrodes.

3. Samples

a. Only as requested by Architect.

4. Quality Assurance/Control Submittals:

a. Test Reports - Testing Laboratory shall submit to DSA-SS, Project Inspector, Architect, Structural Engineer and the Contractor one (1) copy of each report showing results of test.

1) Certified mill test reports of supplied reinforcing indicating chemical and physical analysis. Tensile and bend tests shall be performed by the mill in accordance with ASTM A 615 "Specification for Deformed and Plain Carbon-Steel Bars for Structural Concrete."

2) Testing Laboratory reinforcement tests in accordance with CBC Table 1705A.3, CBC Section 1910A, and the provisions of Specification Section - TESTING LABORATORY SERVICES.

3) Owner will pay for tests of samples taken from identified bundles accompanied by mill analysis.

b. Certificates of Compliance with specified standards:

1) Reinforcing bars.

2) Welded wire fabric.

3) Welding electrodes.

4) Welder's Certification.

5. Closeout Submittals:

a. Project Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.

b. Warranty.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications:

a. Installation shall be done only by an installation firm normally engaged in this business. All work shall be performed by qualified mechanics working under an experienced supervisor.

2. Welding Qualifications:

a. Welding procedures, welding operators and welders shall be qualified in accordance with AWS D1.4 - "Structural Welding Code Reinforcing Steel."

b. Welders shall be recently qualified by Test as prescribed in AWS "Standard Qualifications Procedure."

1) Welders whose work fails to pass inspection shall be re-qualified before performing further welding.

3. Manufacturer/Supplier Qualifications:

a. Acceptable Manufacturers/Suppliers shall be regularly engaged in the manufacture of steel bar and wire fabric reinforcing.

4. Testing Laboratory will be approved by DSA/SSS, and selected by the Architect and the Owner.

B. Regulatory Requirements:

1. In accordance with Specification Section – REGULATORY REQUIREMENTS.
2. General:
   a. Reinforcement work shall conform to ACI 301 "Specifications for Structural Concrete for Buildings," and CBC Section 1905A as minimum standards.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:

1. Deliver reinforcement to Project plainly tagged indicating bar size and length, completely fabricated and ready to set.

B. Storage and protection:

1. Store reinforcement above the ground surface on platforms, skids or other supports, protected from dirt, rust, or other substances which will prevent bonding to the concrete.
2. Use all necessary care to maintain identification after bundles are taken apart.

1.6 WARRANTY

A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:

1. In accordance with manufacturer's written standard warranty:
   a. Warranty Period: One (1) Year.

C. Installer's Warranty:

1. In accordance with the terms of the Specification Section - WARRANTIES.
   a. Warranty Period: One (1) Year.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Deformed Bars: In accordance with ASTM A 706 "Low Alloy Steel Deformed Bars for Concrete Reinforcement" or ASTM A 615 "Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement," Grade as indicated on the structural drawings.

B. Tie Wire: In accordance with ASTM A 82 "Cold Drawn Wire for Concrete Reinforcement," plain, cold-drawn steel.

C. Spirals: Smooth round in accordance with ASTM A 615 "Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement," or cold drawn ASTM A82 "Cold Drawn Wire for Concrete Reinforcement."

D. Welded Wire Fabric: In accordance with ASTM A 1064 "Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete."

E. Steel Dowels: Same grade as bars to which dowels are connected.

2.2 ACCESSORIES

A. Supports for Reinforcement: Provide bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening, deformed bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

1. Supports and spacing of spacers per standards set forth by CRSI/WCRSI Manual of Standard Practice.
2. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are protected by plastic [color to match adjacent concrete surfaces] in accordance with CRSI Class I, or stainless steel in accordance with CRSI, Class II.

B. Welding Electrodes: As per AWS D1.4 "Structural Welding Code for Reinforcing Steel."

C. Mechanical Couplers: Mechanical Couplers shall develop 125 percent of the specified yield strength of the bars, and shall comply with ACI 318 "Building Code Requirements for Structural Concrete and Commentary," Section 25.5.7.1.

2.3 FABRICATION

A. Bending: In accordance with ACI 318 "Building Code Requirements for Structural Concrete and Commentary," except as modified by CBC Sections 1905A.

1. Fabricate reinforcement in accordance with the requirements of ACI 315 "Details and Detailing of Concrete Reinforcement," where specific details are not shown.
2. Inside diameter of bends for stirrups and ties shall not be less than 1-1/2 inches for No. 3 bars, 2 inches for No. 4 bars and 2-1/2 inches for No. 5 bars.
3. Where bent bars are straightened: field bending of bars will only be done in accordance with Structural Engineer’s Review and DSA-SS Steel reinforcement shall not be bent or straightened in a manner that will injure the material. Bars for bending with kinks or bends not shown on the drawings shall not be used. Heating of bars will not be permitted.
4. Provide offsets in rebar (1:6 maximum) where required to maintain clearances.

B. Column ties shall terminate with a minimum turn of 135 degrees plus an extension of at least 6 bar diameters but not less than 4 inches at the free end of bar.

C. Allowable Tolerances:

1. Fabrication:

a.	Sheared length:	1 inch.
b.	Depth of truss bars:	Plus 0, minus 1/2 inch.
c.	Ties:	Plus or minus 1/2 inch.
d.	All other bends:	Plus or minus 1 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Placing:

1. Place Reinforcement accurately.
2. Do not move bars beyond allowable without concurrence of the Structural Engineer.
3. Do not heat, bend, or cut bars without concurrence of the Structural Engineer.
4. Reinforcement shall not be bent after being embedded in hardened concrete.
5. Tie Reinforcement together at all intersections with Tie Wire.
6. Support Reinforcing Bars by bar supports. Place and secure in accordance with CRSI "Specifications for Placing Bar Supports."
7. Placement and support shall be complete.
8. Do not use Reinforcing Bars with kinks or bends except when detailed on the structural drawings.
9. Architect shall approve placement and support before concrete is deposited.
10. Spiral reinforcing shall comply with ACI 318 "Building Code Requirements for Structural Concrete and Commentary."

B. Spacing:

1. Clear space between parallel Reinforcing Bars shall not be less than 1 bar diameter nor less than 1 inch, unless otherwise noted on drawings.

C. Splicing:

1. Splice reinforcing as indicated on Drawings.
    a. Lap Splices: Tie securely with wire to prevent displacement of splices during placement of concrete.
    b. Splice Devices: Install in accordance with manufacturer's written instructions.
        1) Obtain the Architect's review before using.
    c. Do not splice bars except at locations shown without the concurrence of the Structural Engineer.
        1) Where splices in addition to those indicated are required, indicate location on shop drawings clearly and highlight "for the Architect's approval."
2. Stagger splices as indicated on drawings. Splice locations shall be as shown on drawings or shall be approved by Structural Engineer and DSA-SS.
    a. Near floors.
    b. Ductile concrete columns must splice at the centerline of the column height.
    c. As detailed on the drawings.
3. Where vertical Reinforcing Bars are offset at a splice, the slope of the inclined portion of bar with the axis of the column or wall shall not exceed 1 in 6.
4. Welded Wire Fabric:
    a. Install in long lengths, lapping 24 inches at end splices and one mesh at side splices.
    b. Offset laps in adjacent widths.
    c. Place fabric in approximately the middle of the slab thickness unless otherwise shown on the drawings.
    d. Wire tie lap joints at 12 inch centers.
    e. Use concrete blocks to support mesh in proper position.
5. Mechanical bar splices shall be approved by the Structural Engineer and DSA-SS.

D. Welding:
1. Welding is not permitted unless specifically detailed on Drawings or approved by the Architect.
2. Weld under supervision of qualified Testing Laboratory selected by Owner. Cost of supervision to be paid by the Owner. Weld only ASTM A706 "Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement," unless otherwise noted.
3. Employ shielding metal-arc method and meet requirements of AWS D1.4 "Structural Welding Code for Reinforcing Steel."
4. Welding is not permitted on bars where carbon equivalent is unknown or is determined to exceed 0.55.
5. Welding shall not be done within two bar diameters of any bent portion of a bar which has been bent cold.
6. Welding of crossing bars is not permitted.
7. Provide material properties supplemental report for bars other than ASTM A706 "Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement."
8. Weld in accordance with AWS D1.4 "Structural Welding Code for Reinforcing Steel."
    a. Weld only where indicated on the drawings.
    b. Weld only ASTM A706 "Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement,".
9. Inspection provided per CBC Table 1705A.3.

E. Allowable Tolerances:
1. Placement:
    a. Concrete cover to form surfaces: Plus or minus 1/4 inch.
    b. Minimum spacing between bars: Plus or minus 1/4 inch.

c. Crosswise of members: Spaced evenly with 2 inches of stated separation.
d. Lengthwise of members: Plus or minus 2 inches.

2. Maximum bar movement to avoid interference with other reinforcing steel, conduits, or embedded items: 2 bar diameters.

F. Drawing Notes: Refer to notes on Drawings for additional reinforcement requirements.

G. Mechanical, Electrical and Plumbing Drawings:

1. Refer to Mechanical, Electrical and Plumbing drawings for formed concrete requiring reinforcing steel.
2. All such steel shall be included under the work of this section.

3.2 CONSTRUCTION

A. Corrective Measures:

1. Notify Architect if conduit, piping, inserts, sleeves, etc. interfere with placement of Concrete Reinforcement as indicated on Drawings. Notify Architect immediately if any Concrete Reinforcement is found to be misplaced after concrete has been poured.
2. Do not cut, bend, kink or hickey misplaced reinforcement.
3. Make corrections only as directed by Architect, reviewed by the Structural Engineer and approved by DSA-SS.
4. The Contractor shall bear the cost of any alteration, corrections or replacements of Concrete Reinforcing to concrete required because of misplaced reinforcement.

3.3 FIELD AND QUALITY CONTROL

A. Site Tests:

1. When inspections are indicated for reinforcement placement on the Structural drawings, a special inspector shall be employed to inspect reinforcing placement per CBC Table 1705A.3.
2. Inspect shop and field welding in accordance with AWS D1.4 "Structural Welding Code for Reinforcing Steel," including checking materials, equipment, procedure and welder qualifications as well as the welds. Inspector will use non-destructive testing or any other aid to visual inspection that he deems necessary to assure himself of the adequacy of the weld.

B. Inspections:

1. All reinforcing steel whose properties are not identifiable by mill test reports shall be tested in accordance ASTM A615.One series of tests shall be performed for each missing report. Contractor shall pay for test required due to lack of positive identification, by means of a back charge by the Owner.
2. When tests are indicated for reinforcing steel on the structural drawings, the reinforcing steel used shall be tested in accordance with ASTM A 615 "Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement." One tensile and one bend test for each 2-1/2 tons of steel or fraction thereof, shall be made.

C. Tests and Inspection shall be performed by Owner's Testing Laboratory except when needed to justify rejected work, in which case the cost of re-tests and re-inspection shall be borne by the Contractor.

3.4 CLEANING

A. Reinforcement, at time concrete is placed, shall be free of loose rust scale, mud, oil or other coating that will destroy or reduce the bond.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all Cast-In-Place Concrete materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
    a. Footings.
    b. Foundation Walls.
    c. Slab on Grade.
    d. Building Walls.
    e. Site Improvements.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 11 01 CONCRETE FORMWORK
4. 03 15 14 DRILLED ANCHORS
5. 03 20 00 REINFORCEMENT
6. 03 35 00 POLISHED CONCRETE FINISHING
7. 04 22 00 CONCRETE MASONRY UNITS
8. 05 12 00 STEEL AND FABRICATIONS
9. 05 30 00 METAL DECK
10. 06 10 00 ROUGH CARPENTRY
11. 07 14 16 FLUID-APPLIED WATERPROOFING
12. 07 18 50 VAPOR-ALKALINITY CONTROL
13. 07 40 00 METAL PANELS
14. 07 84 00 FIRESTOPPING
15. 07 92 00 SEALANTS
16. 08 41 00 STOREFRONTS
17. 09 22 16 METAL FRAMING
18. 09 30 00 TILE
19. 09 65 10 RESILIENT BASE AND ACCESSORIES
20. 09 65 19 RESILIENT TILE
21. 09 67 23 RESINOUS FLOORING
22. 10 05 00 MISCELLANEOUS SPECIALTIES
23. 10 14 00 IDENTIFYING DEVICES
24. 10 14 53 ROAD AND PARKING SIGNAGE
25. 31 20 00 EARTHWORK
26. 31 31 00 SOIL TREATMENT
27. 32 12 00 PAVEMENT
28. 32 31 13 CHAIN LINK
29. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
30. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 REFERENCES

A. Standards:

1. In accordance with the following standards:
    a. ACI American Concrete Institute
    b. ASTM American Society of Testing Materials.
    c. RFCI The Resilient Floor Covering Institute

d. RMAI Rubber Manufacturers Association Inc.

1.3 SYSTEM DESCRIPTION

A. Design Requirements:

1. Make ready all interior concrete substrates to receive flooring:
   a. Ensure the proper levelness and flatness of all concrete substrates for the intended flooring products.
      1) If leveling materials are required because of inadequate leveling during the pour and curing periods, follow all manufacturers written instructions for the proper preparation and application of these products.
      2) Verify that the concrete substrates are at the right RH (Relative Humidity) and Alkalinity Levels for the leveling materials in accordance with manufacturers written instructions.
   b. Keep finished concrete substrates clean and ready for scheduled flooring applications during the construction process.
      1) Protect those substrates from excessive moisture build-up, and keep free of moisture puddles.
      2) Ensure that construction equipment does not leak fluids on substrates that would prevent bonding of flooring adhesives at the proper time for flooring installations.
   c. Provide concrete substrates that are within acceptable limits of RH and that the Alkalinity of the concrete substrates are within the acceptable levels for adhesively applied flooring at the scheduled time for flooring installations.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Coordination Drawings:
   a. Layout drawings for construction, control and expansion joints.
      1) Coordinate joints with floor patterns.
2. Product Data.
   a. Submit data on all products listed under MATERIALS, and ACCESSORIES within this specification section.
3. Quality Assurance/Control Submittals:
   a. Coordinate with Specification Section - TESTING LABORATORY SERVICES for additional Testing Requirements as required by DSA.
   b. Material samples and mix designs:
      1) Material samples and mix designs as required for testing shall be submitted to Architect at least fourteen (14) days prior to any concrete work and shall include results of test data used to establish proportions.
         a) Grout samples and colors for colored surfaces upon Architect's request only.
   c. Continuous Batch Plant Inspection is waived for this project in compliance with CBC Section 1705A.3.3.1, subject to the following requirements:
      1) The concrete plant complies fully with the requirements of ASTM C94, Sections 9 and 10, and has a current certificate from the National Ready Mixed Concrete Association or another agency acceptable to the **DSA-SS**. The certification shall indicate that the plant has automatic batching and recording capabilities.
      2) The special inspector shall check the first batch at the start of the day to verify materials and proportions conform to the approved mix design.

3) A licensed Weighmaster shall positively identify the quantity of materials and certify each load with a batch ticket.
4) Batch tickets shall accompany the load and be transmitted to the Inspector of Record by the truck driver with the load identifies thereon. The load shall not be placed without a batch ticket identifying the mix. The Inspector of Record shall keep a daily record of placements, identifying each truck, its load, and the time of receipt at the jobsite, and approximate location of deposit in the structure. A copy of the daily record shall be maintained.

d. Test Reports:
1) Testing Laboratory shall submit to Architect, Structural Engineer, Owner, and to the DSA one (1) copy of each report showing results of tests.
a) Report shall state whether materials were in conformance with specifications.
b) Report shall state whether the curing of the concrete slabs are within parameters required for future flooring installations.
2) Moisture and Alkalinity Tests.
a) Relative Humidity (RH).
b) Moisture Vapor Emission Report (MVER).

e. Certificates:
1) Submit three (3) copies of certificates.
a) Provide Vapor Retarder manufacturer's certificate of inspection and compliance to installation procedures.
b) Cement manufacturer's Mill Certificate of Compliance with the specification.
c) Certificates for aggregates and admixtures.

4. Closeout Submittals:
a. Project Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.
b. Warranty.

1.5 QUALITY ASSURANCE

A. Qualifications:
1. Installer Qualifications:
a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
2. Manufacturer/Supplier Qualifications:
a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the Work.
3. Testing Laboratory Qualifications:
a. Qualified Testing Laboratory and personnel approved by DSA-SS.
1) Cost of testing and inspection will be paid by the Owner unless otherwise specified. The Owner shall pay all costs of re-inspection and/or re-tests due to non-compliance with specifications and/or failures, but the Contractor shall reimburse the Owner for these tests when billed or deducted from its payment.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:

a. All materials, equipment and placing operations shall be subject to inspection, tests and approval at all items. Testing Agent shall have free and unhampered access to all places where concrete materials are stored proportioned and mixed.

C. Mockups:

1. Provide mockups prior to application of work and prior to installation of any materials.
2. Mockups shall be used for establishing construction sequences, installation requirements of materials, and shall be representative for the intended end-use configuration.
3. Mockup Assemblies:
   a. Polished Concrete Finishing: Mockups shall be the placement of concrete and shall integrate all other related work, but not limited to, Specification Section - POLISHED CONCRETE FINISHING.
   b. Slab-On-Grade: Mockups shall be the finish and texture of concrete.
      1) Mockups shall be a minimum overall size of 3' x 3' x 4" thick panels.
      2) Provide Mockups for each texture and finish required.
4. Installation of Mockups:
   a. The Project Inspector, the Architect, and Contractor's Superintendent shall observe the installation of materials and work.
   b. Installation crew for the Mockups shall be the Cast-In-Place Concrete, Reinforcement and Polished Concrete Finishing installers for this project and installers, as necessary, of other related work.
   c. Unacceptable Mockups shall be removed and reinstalled until the work is deemed to be in compliance with the project requirements and is acceptable by the Owner, Architect and Project Inspector.
5. Allow 24 hours for inspection of mockup before proceeding with work.
6. Protect the Mockups during the course of construction.
7. Remove mockup and dispose of materials when no longer required and when directed by the Architect at the end of the project.

D. Meetings:

1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
   a. Coordinate the work with other related work being performed.
      1) Schedule pre-construction conference with Vapor Retarder Manufacturer prior to installation at least one week prior to scheduled installation.
      2) Schedule pre-construction conference with Polished Concrete Contractor prior to installation to discuss specific requirements of the Polished Concrete Finishing requirements. Coordinate with Specification Section - POLISHED CONCRETE FINISHING.
   b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
   c. Prior to submitting design mixes, review detailed requirements for preparing concrete design mixes and determine procedures for satisfactory concrete operations.
   d. Review requirements for submittals, status of coordinating work, and availability of materials.
   e. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications.
2. Progress: Scheduled by the Contractor during the performance of the work.
   a. Review for proper installation of work progress.
      1) Schedule installation review at the start of installation with the Vapor Retarder Manufacturer to ensure all of the manufacturers written instructions are complied with.
   b. Identify any installation problems and acceptable corrective measures.

c. Identify any measures to maintain or regain project schedule if necessary.

3. Completion: Scheduled by the Contractor upon proper completion of the work.

a. Inspect and identify any problems that may impede issuance of warranties or guaranties.

1) Prior to covering up the Vapor Retarder installation with concrete, have the Vapor Retarder manufacturer inspect and provide a certified report to the Architect the condition of the Vapor Retarder prior to being covered with concrete, and that the installation was in full compliance with the manufacturer's written instructions.

b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.6 PROJECT CONDITIONS

A. Environmental requirements:

1. Cold Weather Requirements:

a. Comply with ACR 306R – Guide to Cold Weather Concreting.
b. Do not pour concrete unless air temperature is at least 40 degrees Fahrenheit and rising.
c. Do not pour concrete on frozen ground or ice.
d. Heat and otherwise prepare materials in accordance with ACI Standard 306.
e. Maintain concrete temperature at 50 degrees Fahrenheit (minimum) the first three (3) days after pouring. Protect concrete from freezing the first six (6) six days, after placing.

2. Hot Weather Requirements:

a. Comply with ACI 305R – Guide to Hot Weather Concreting.
b. Do not pour when temperature exceeds 90 degrees Fahrenheit.
c. During hot weather, proper attention shall be given to ingredients, production methods, handling, placing, protection, and curing to prevent excessive Concrete temperatures or water evaporation, which will impair the required strength or serviceability of the member or structure.

1.7 WARRANTY

A. Contractor's General Warranty: In accordance with Specification Section – WARRANTIES.

B. Manufacturer's Warranty, in accordance with manufacturer's written standard warranty:

a. Warranty Period: One (1) Year.

C. Installer's Warranty, in accordance with Specification Section – WARRANTIES.

a. Warranty period: One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 CONCRETE MATERIALS

1. Cement: Type II or V in accordance with ACI 318 "Building Code Requirements for Structural Concrete and Commentary," Chapter 3, and ASTM C 150 "Specifications for Portland Cement."
   a. Natural (Grey) Portland Cement:
      1) LEHIGH PORTLAND CEMENT COMPANY.
      2) MARTIN MARIETTA (TXI CEMENT COMPANY).
   b. White Cement:
      1) LEHIGH WHITE CEMENT
      2) MARTIN MARIETTA (TXI CEMENT COMPANY).
   c. Provide white cement for mixing when the Project requires patching for defective work, to match adjacent material color. See Specification Section - CAST-IN-PLACE CONCRETE, Part 3 Article titled "APPLICATIONS," the paragraph titled "Sack Finish."
2. Water: Clean and free from deleterious amounts of acids, alkalis, salts, organic material, or other substances that may be deleterious to concrete or reinforcing.
3. Aggregates:
   a. Normal weight aggregates in accordance with ACI 318 "Building Code Requirements for Structural Concrete and Commentary," Chapter 3 and ASTM C33 "Standard Specifications for Concrete Aggregates." Crushed Granite or "Perkins" type aggregates are acceptable materials.
      1) Maximum Aggregate Size: 1-1/2 inches for standard aggregate.
      2) Coarse aggregate when tested in accordance with State of California Highways Test Methods 227 shall have a cleanliness value of 75 minimum.
      3) Fine aggregates when tested in accordance with State of California Highways Test Methods 217 shall have a sand equivalent of 75 minimum.
4. Admixtures: Admixtures shall be in accordance with the provisions of ACI 318 "Building Code Requirements for Structural Concrete and Commentary," Section 3.6, and shall not be used until prior approval from DSA has been obtained. Calcium Chloride is not permitted.
   a. Air Entraining:
      1) Conform to ASTM C 260 "Specifications for Air-Entraining Admixtures for Concrete."
   b. Fly Ash:
      1) Conform to ASTM C 618 "Specification for Coal Fly Ash and Raw or Calcined Natural Possolan for Use in Concrete."
      2) Class "C" Fly Ash is not permitted per CBC 1903A.6.
   c. Water Reducing, High Range: On approval of DSA , the Architect and the Structural Engineer, the Contractor may use a High Range Water Reducing Admixture complying with ASTM C 494 "Specification for Chemical Admixtures for Concrete." Use one of the following materials:
      1) Finish Enhancing Water Reducer; "ADVA 170" by GCP APPLIED TECHNOLOGIES.
      2) ASTM C 494 "Specification for Chemical Admixtures for Concrete," Type F.
   d. Shrinkage Control:
      1) Conform to ASTM C 494 "Specification for Chemical Admixtures for Concrete," Type S.
      2) Specified product manufacturer: SIKA CONTROL-40.
      3) Acceptable alternative product manufacturer:

a) THE EUCLID CHEMICAL COMPANY: "Eurcon SRA Floor".

4) Verify and provide Shrinkage control compatible with Polished Concrete Finishing.

e. Integral Concrete Waterproofing:

1) Crystalline Waterproofing: Prepackaged, gray-colored proprietary blend of portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates into concrete and reacts chemically with the byproducts of cement hydration in the presence of water to develop crystalline growth within substrate capillaries to produce an impervious, dense, waterproof substrate.

2) Specified product manufacturer: XYPEX.

a) ADMIX C-500.

2.3 SLAB ON GRADE BASE MATERIALS

A. Rock Base:

1. Clean mixture of crushed stone or uncrushed gravel, in accordance with ASTM D 448 "Standard Classification for Sizes of Aggregate for Road and Bridge Construction."

a. Top Layer:

1) Percent passing a 1-inch sieve: 100 percent.
2) Percent passing No. 8 sieve: 0 to 5 percent.

b. Bottom Layer:

1) Percent passing a 2-inch sieve: 100 percent.
2) Percent passing No. 8 sieve: 0 to 5 percent.

2.4 VAPOR RETARDER

A. Vapor Retarder: Physical Requirements in accordance with ASTM E 1745 "Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs," Class A Material, are as follows:

1. Thickness: 15 mils minimum.
2. Permeance: 0.01 Perms.

a. Maintain permeance of less than 0.01 perms after mandatory conditioning tests per ASTM E 154 "Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover," Sections 8, 11, 12, and 13.

3. Tensile Strength: 45.0 lbf/in.

a. Per ASTM E 154 "Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover," Sec. 9, ASTM D 828 "Standard Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus:"

4. Resistance to Puncture: 2200 grams.

a. ASTM E 154 "Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover", Sec. 10, ASTM D 1709 "Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method:"

5. Resistance to decay:

a. Per ASTM E 154 "Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover."

6. Use pressure sensitive seam tape compatible with materials to be seamed in accordance with manufacturer's written recommendations.

a. Water vapor Transmission Rate: 0.3 perms or lower.

1) Per ASTM E 96 "Test Methods for Water Transmission of Materials."

7. Vapor Proof Mastic: 0.3 perms or lower.
   a. Water vapor Transmission Rate: 0.3 perms or lower.
      1) Per ASTM E 96 "Test Methods for Water Transmission of Materials."
8. Pipe Boots: Construct pipe boots from vapor retarder material, pressure sensitive seam tape, and /or mastic per manufacturer's written instructions.
9. Vapor Stakes:
   a. Density: 0.0289 lb/cu.in.
      1) Per ASTM D 1505 "Test Method for Density of Plastics by the Density-Gradient Technique."
   b. Specific Gravity: 0.0477.
      1) Per ASTM D 792 "Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement."
10. Specified product manufacturer: STEGO INDUSTRIES.
    a. "Stego-Wrap" ("Yellow" color).
    b. Acceptable alternative product manufacturers:
       1) EPRO SERVICES, INC.: "Ecoshield-E15" ("Red" color).
       2) W.R. MEADOWS: "Perminator 15" ("Green" color).

2.5 ACCESSORIES

A. Bonding Agents: Polyvinyl acetate or acrylic base, mixed in accordance with the manufacturer's written recommendations.
   1. Specified product manufacturer: CONRAD SOVIG CO., INC.
      a. "Cemlok-NE."
   2. Acceptable alternative product manufacturers:
      a. THE EUCLID CHEMICAL COMPANY: "Eucoweld."
      b. LARSON PRODUCTS CORPORATION: "Weld-Crete."
      c. SONNEBORN: "Sonobond."
      d. GCP APPLIED TECHNOLOGIES, INC: "Darweld C."
      e. W.R. MEADOWS: "Deck-O-Weld."

B. Mortar:
   1. Site Mix:
      a. Composed of Concrete Materials indicated in Specification Section - CAST-IN-PLACE CONCRETE, Part 2 Article titled "MATERIALS."
         1) Mix: One part cement to 3 parts aggregate (all aggregate shall pass No. 4 sieve).
         2) Mixing: Thoroughly mixed in accordance with ACI 318 "Building Code Requirements for Structural Concrete and Commentary."
   2. Concrete Mortar:
      a. Greater than 1/4 inch thick: Floor leveling, patching and repair, non-shrink trowel applied concrete mortar where repair areas of fill.
   3. Epoxy Concrete Mortar:
      a. Less than 1/4 inch thick: Floor leveling, non-shrink trowel applied epoxy concrete mortar where repair areas to fill.
      b. Specified manufacturer: GENERAL POLYMER CORPORATION: "TPM 115."
      c. Acceptable alternative product manufacturer:
         1) ANTI-HYDRO CORPORATION: "A-H Emery Epoxy Topping #170."
   4. Epoxy Mortar and Adhesive Materials:

a. Modified Polyamide, high modulus mortar, strength to match adjacent concrete or greater, in accordance with ASTM C 881 "Specification for Epoxy-Resin-Base Bonding Systems for Concrete," Grade 1, Type III, Class B & C, and in accordance with ACI 503.4, mixed in accordance with the manufacturer's written recommendations.

b. Specified product manufacturer: W.R. MEADOWS.

1) "Rezi-Weld," "LV, 1000" or "Gel-Paste" as suitable for application.

c. Acceptable alternative product manufacturers:

1) THE EUCLID CHEMICAL COMPANY: "Euco #456."

C. Grout:

1. Strength to match adjacent concrete or greater, composed of specified Concrete Materials.

a. Mix: Same proportions as concrete mix except omit coarse aggregate and adjust water to produce a thick consistency. Provide mix design per CBC Section 1904A.2.

b. Mixing: In accordance with ACI 318 "Building Code Requirements for Structural Concrete and Commentary," mixed in accordance with the manufacturer's written recommendation.

2. Non-Shrink Grout: Flowable, non-shrink, self-leveling, non-staining, non-metallic grout, strength to match adjacent concrete or greater, and in compliance with ASTM C 1107 "Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)," mixed in accordance with the manufacturer's written recommendation.

a. Specified product manufacturer:

1) MINWAX CONSTRUCTION PRODUCTS COMPANY

a) "POR-ROK", Epoxy Grout.

b. Acceptable alternative product manufacturers:

1) MASTER BUILDERS: "713."

2) MASTER BUILDERS: "928."

3. Drypack Grout: Non-staining, non-shrink, non-metallic grout, strength to match adjacent concrete or greater, and in accordance with ASTM C 1107 "Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)," mixed in accordance with the manufacturer's written recommendation.

a. Specified product manufacturer:

1) THE EUCLID CHEMICAL COMPANY: "Euco Dry Pack Grout."

b. Acceptable alternative product manufacturers:

1) W.R. MEADOWS: "Pac-It Grout."

2.6 JOINT FILLERS

A. Waterstops: Provide polyvinyl chloride type waterstops, model number and size to fit the construction required, in accordance with the Corps of Engineers standard CRD-C 572.

1. Specified product manufacturer:

a. GREENSTREAK PLASTIC PRODUCTS CO. “Polyvinyl Chloride Type.”

B. Fiber Expansion Joint Filler: 1/4" thick at vertical joints and 1/2" thick under thresholds (unless specifically noted otherwise), asphalt saturated fiber expansion joint filler, in accordance with ASTM D 1751 "Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)."

1. Specified product manufacturer:

a. W.R. MEADOWS: "Sealtight Fiber Expansion Joint Filler."

b. Acceptable alternative product manufacturer:

1) CELOTEX CORP.: "Flexcell."

2) PHILLIP CAREY MFG. CO.: "Elastic Fiber Expansion Joint."

C. Semi-Rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240 "Standard Test Method for Rubber Property – Durometer Hardness."

1. Specified product manufacturer:

a. W.R. MEADOWS: "Rezi-Weld Flex."

D. Polished Concrete Joint Filler: A two-component, 100% solids semi-rigid epoxy for filling control and construction joints in industrial concrete floors. This product supports the joint edges and reduces spalling of the edges caused by wheel traffic. EUCO 700 has been designed for use in compliance with ACI 302 recommendations for epoxy joint fillers used in control and construction joints.

1. Specified product manufacturer: EUCLID "Euco 700."

~~E. Foam Expansion Joint Filler: Extruded Polystyrene Foam products, in accordance with ASTM C 578 "Specification for Rigid, Cellular Polystyrene Thermal Insulation," thickness and depth as indicated on the drawings.~~

~~1. Specified Product Manufacturer:~~

~~a. DOW CHEMICAL CORP.: "Styrofoam."~~

~~b. Acceptable alternative product manufacturers:~~

~~1) U.C. INDUSTRIES: "Foamular."~~

~~F. Redwood Joint Filler:~~

~~1. Selected sound heart redwood in accordance with RIS "Standard Specifications for Grades of California Redwood Lumber," Section 211 (c) and Section 306.~~

2.7 CURING MATERIALS

A. Curing Paper (Absorptive Covers): Products complying with:

1. Specified product manufacturer:

a. FORTIFIBER CORPORATION: "Orange Label Sisalkraft."

2. ASTM C 171 "Specification for Sheet materials for Curing Concrete."

B. Slab Curing Compound (SCC): Provide liquid-type membrane-forming sealing compound, non-yellowing, VOC compliant cure and seal, complying with ASTM C 309 "Specification for Liquid Membrane-Forming Compounds for Curing Concrete," Type I, Class A, that when dry is clear in color. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq.ft./gal.

1. Specified product manufacturer:

a. THE EUCLID CHEMICAL COMPANY: "Cure-Crete WB."

b. Acceptable alternative product manufacturers:

1) W.R. MEADOWS: "Sealtight 1100 CLEAR."

C. Clear Floor Sealer (CFS): Provide liquid-type membrane-forming sealing compound, non-yellowing, VOC compliant cure and seal, complying with ASTM C 309 "Specification for Liquid Membrane-Forming Compounds for Curing Concrete," Type I, Class A, that when dry is clear in color. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq.ft./gal.

1. Specified product manufacturer:

a. THE EUCLID CHEMICAL COMPANY: "Diamond Clear VOX."

b. Acceptable alternative product manufacturers:

1) W.R. MEADOWS: "Sealtight VOComp 25."

2.8 FLOOR AND SLAB TREATMENTS

A. Clear Floor Hardener (CFH): Provide products that are ready-to-use, dry-shake type, VOC compliant clear hardeners, with surface conditioning and dispersing agents, portland cement

blended with hard, graded aggregate, mixed in accordance with the manufacturer's written recommendations.

1. Specified product manufacturer:
   a. SIKA CORPORATION: "Emerchrome Clear Floor Hardener."

B. Colored Floor Hardener (COFH): Provide products that are ready-to-use, dry-shake type, VOC compliant colored hardeners, with surface conditioning and dispersing agents, portland cement blended with hard, graded aggregate, mixed in accordance with the manufacturer's written recommendations.

1. Specified product manufacturer:
   a. SIKA CORPORATION: "Lithochrome Color Hardener" and "Lithochrome Color Sealer."

C. Sack Finish Materials: For repair and patching of defective areas.

1. Provide sack finish materials composed of Concrete Materials indicated in Specification Section - CAST-IN-PLACE CONCRETE, Part 2 Article titled "MATERIALS." Sand shall be fine.
2. Mix: One part cement to one part fine sand with enough water to provide a creamy consistency.

D. Cementitious Based Underlayment Compounds (CBUC): Provide free-flowing, self-leveling, pumpable, cement based compound for applications from 1-1/4 inch thick to feathered edges, 4500 psi minimum in accordance with ASTM C 109 "Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. (or 50-mm) Cube Specimens)."

1. Specified product manufacturer:
   a. ARDEX: "V-1200."
   b. Acceptable alternative product manufacturers:
      1) MAPEI: "Ultraflex."
      2) QUIKRETE PRODUCTS CORP.: "QUIKRETE No. 1249."

2.9 TRUNCATED DOMES

A. General:

1. ~~Imprinting tools, forms and m~~Mats shall be in accordance with ADA Standards for Accessible Design, Section 4.29.2, CBC Sections 11B-705, California Government Code Section 4451(d), and IR 11B-4.

B. Cast-In-Place Replaceable Mat:

1. Specified product manufacturer: ADA SOLUTIONS, INC.
2. Provide and install cast-in-place mat of homogeneous glass and carbon reinforced composite material.
3. Provide Integral Uniform Color throughout product, Yellow, approximate 33538 of SAE AMS-STD-595A.
4. Material Physical Characteristics:
   a. Compressive Strength: greater than 28,000 psi per ASTM D 695.
   b. Tensile Strength: greater than 11,000 psi per ASTM D 638.
   c. Water Absorption: less than 0.10 percent per ASTM D 570.
   d. Slip Resistance: less than 1.00 Wet/Dry Static per ASTM C 1028.
   e. Flame Spread Index: less than 25 per ASTM E 84.
5. Dimensions: Statistics of Truncated Domes per CBC 11B-705.1:
   a. Base Diameter of Dome: 0.90 to 0.92 inch.
   b. Top Diameter of the Dome: 0.45 to 0.47 inch.
   c. Height of the Dome: 0.2 inch.
   d. Center to Center Spacing of Domes in-line pattern: 2.3 to 2.4 inches.
   e. All edges of panel shall have a square edge.

2.10 CONCRETE MIXES, GENERAL

A. Mix Design and Proportions in accordance with ACI 318 "Building Code Requirements for Structural Concrete and Commentary:"

B. Initial mix design shall be prepared for all concrete by recognizing testing laboratory approved by Architect. In the event that additional mix designs are required due to depletion of aggregate sources, aggregate not conforming to Specifications, or at request of Contractor, these mixes shall be prepared as above.

C. Contractor shall notify the Testing Laboratory and Architect of intent to use concrete pumps to place concrete so that mix designs can be modified accordingly.

D. Mix designs with Fly Ash content greater than 15 percent of the total weight of cementitious materials shall be proportioned by ACI 318 "Building Code Requirements for Structural Concrete and Commentary."

1. Provide 3 percent air entrainment typical, 6 percent for mixes with f'c greater than 4,000 psi when required.

E. Owner's testing laboratory shall review all mix design before submittal.

2.11 CONCRETE MIXES

A. All concrete shall have the following minimum compressive strengths in accordance with ACI 318 "Building Code Requirements for Structural Concrete and Commentary" at 28 days and shall be proportioned within the following limits:

B. Foundations: Use for unexposed foundation concrete except as otherwise specified:

1. Strength: 3,000 psi at 28 days.
2. Max. Aggregate Size: 1-1/2 inch.
3. Max. Water/Cement Ratio: 0.58.
4. Admixture: Water Reducing.
5. Weight: 145 pcf.

C. Building Walk-in Slabs: Use for interior floating building slabs at walk-in coolers and freezers:

1. Strength: 3,500 psi at 28 days.
2. Max. Aggregate Size: 1 inch.
3. Max. Water/Cement Ratio: 0.45.
4. Admixture: Water Reducing + Integral Concrete Waterproofing
5. Weight: 145 pcf.

D.

~~C.~~E. Building Slab On Grade: Use for interior building slab on grade, except as otherwise specified:

1. Strength: 3,500 psi at 28 days.
2. Max. Aggregate Size: 1 inch.
3. Max. Water/Cement Ratio: 0.45.
4. Admixture: Water Reducing + Fly Ash.
5. Weight: 145 pcf.

~~D.~~F. Mechanical Yard Structural Slab on Grade:

1. Strength: 4,000 psi at 28 days.
2. Max. Aggregate Size: 1-1/2 inch, well graded.
3. Max. Water Cement Ratio: 0.58.
4. Admixture: Water Reducing + Fly Ash
5. Weight: 145 pcf.

~~E. Structural Concrete: Use for columns, beams and walls, except as otherwise specified:~~

~~1. Strength: 4,000 psi at 28 days.~~
~~2. Max. Aggregate Size: 1 inch.~~
~~3. Max. Water/Cement Ratio: 0.50.~~

~~4. Admixture: Water Reducing.~~
~~5. Weight: 145 pcf.~~

~~F.~~G. Site: Use for exterior concrete slabs on grade such as walks, site work, mechanical and electrical pads and miscellaneous site items:

1. Strength: 3,000 psi at 28 days.
2. Max. Aggregate Size: 1 inch.
3. Max. Water/Cement Ratio: 0.60.
4. Admixture: Water Reducing.
5. Weight: 145 pcf.

~~G. Architectural: Used for all highly detailed concrete items such as signs, plaques, landscape furnishings, columns, walls, etc.:~~

~~1. Strength: 3,000 psi at 28 days.~~
~~2. Max. Aggregate Size: 3/8 inch.~~
~~3. Max. Water/Cement Ratio: 0.64.~~
~~4. Admixture: Plasticizing admixtures used to create maximum workability at minimum slump.~~
~~5. Weight: 145 pcf.~~

H. Lean mix: Used for Back Fill of over excavated trenches, encasement of all penetrations, plumbing pipe, mechanical pipe under footings (plumbing & mechanical pipes and electrical conduits):

1. Strength: 1,500 psi at 28 days.
2. Max. Aggregate Size: 3/8 inch.
3. Max. Water/Cement Ratio: 0.62.
4. Admixture: None.
5. Weight: 145 pcf.

2.12 CONCRETE MIXING

A. Consistency of Concrete: Concrete slump, measured in accordance with ASTM C 143 "Test method for Slump of Hydraulic-Cement Concrete," shall fall within the following limits:

1. For General concrete placement: 3 inch plus or minus 1 inch.
   a. Polished Concrete Mix: 5" maximum.
2. Mixes employing the specified high range water reducer shall provide a measured slump not to exceed 7 inch +/- 1 inch after dosing, 2 inch +/- 1 inch before dosing.
   a. Polished Concrete Mix: 6" maximum if using water reducing admixture in lieu of water.
3. Concrete slump shall be taken at point of placement. Use water reducing admixtures as required, to provide a workable consistency for pump mixers. Water shall not be added in route by truck or at the jobsite without written review by the Architect.

B. Mixing:

1. Equipment: All concrete shall be machine mixed. Provide adequate equipment and facilities for accurate measurement and control of materials.
2. Method of Mixing to comply with ACI 318 "Building Code Requirements for Structural Concrete and Commentary:"
   a. Transit Mixing: Comply with ASTM C 94 "Specification for Ready-Mixed Concrete." Ready mixed concrete shall be used throughout, except as specified below.
      1) On-Site Mixing: Use only if method of storing material, mixing of material and type of mixing equipment is approved by Architect.
      2) Approval of site mixing does not relieve Contractor of any other requirements of Specifications.

3. Mixing Time: After mix water has been added, concrete shall be mixed not less than 1-1/2 minutes nor more than 1-1/2 hours. Concrete shall be rejected if not deposited within the time specified.
4. Admixtures:
    a. Use automatic metering dispenser to introduce admixture into mix. Dispenser shall be recommended and calibrated by admixture manufacturer.
        1) Integrally Colored Concrete Color Pigment: Follow the manufacturers written recommendations for proper mixing of the selected pigment color.
    b. Water Reducers may be used in concrete slabs on grade identified with a Polished Concrete Finish - coordinate with Specification Section - POLISHED CONCRETE FINISHING.
    c. Admixtures shall be charged into mixer as a solution and shall be dispensed by an automatic dispenser or similar metering device. Powdered admixtures shall be weighed or measured by volume as recommended by manufacturer. Accuracy of measurement of any admixture shall be within plus or minus 3 percent.
    d. Two or more admixtures may be used in same concrete, provided such admixtures are added separately during batching sequence, and provided further that admixtures used in that combination retain full efficiency and have no deleterious effect on concrete or on properties of each other.
    e. All admixtures are to be approved by Architect prior to commencing this work.
5. Re-tempering:
    a. Concrete shall be mixed only in quantities for immediate use. Concrete, which has set shall be discarded, not re-tempered.
    b. Indiscriminate addition of water to increase slump is prohibited.
    c. When concrete arrives at project with slump below what is suitable for placing, water may be added only if neither maximum permissible water-cement ratio nor maximum slump is exceeded.
        1) Water shall be incorporated by additional mixing equal to at least half of total mixing time required.
        2) Any addition of water above that permitted by limitation of water-cement ratio shall be accompanied by a quantity of cement sufficient to maintain proper water-cement ratio.
        3) Such additions shall only be used if approved by the Architect.
        4) In any event, with or without addition of cement, not more than 2 gallons of water per cubic yard of concrete, over that specified in the design mix, shall be added.
6. Cold Weather Batching: When temperature is below 40 degrees F, or is likely to fall below 40 degrees F during a 24 hour period after placing, provide adequate equipment for heating concrete materials.
    a. No frozen materials or materials containing ice shall be used.
    b. Temperatures of separate materials, including mixing water, when placed in mixer shall not exceed 100 degrees F.
    c. When placed in forms, concrete shall have a temperature between 50 degrees F and 85 degrees F.
7. Hot Weather Batching: Concrete deposited in hot weather shall have a placing temperature below 85 degrees F. If necessary, ingredients shall be cooled to accomplish this.

2.13 FINISHES

A. Slab Finishes:
    1. Tooled Finishes:

a. Scratch Finish: Apply scratch finish to slab surfaces to receive concrete floor topping or mortar setting beds for tile, and other bonded applied cementitous finish flooring material.

b. Float Finish: Apply float finish to slab surfaces to receive trowel finish and other finishes as specified; membranes, elastic waterproofing, elastic roofing, or sand-bed terrazzo.

c. Trowel Finish: Apply a non-slip trowel finish to surfaces to be covered with resilient flooring, thin-set ceramic or quarry tile, paint or another thin film-finish coating system

d. Sweat Trowel Finish: Apply a non-slip steel trowel ("sweat") finish (tight circular motion pattern approved by the Architect) to slab surfaces exposed to view.

1) All exterior concrete paving and concrete finishes, at exterior concrete platforms, steps, ramps, walks, and other areas requiring non-slip finishes, unless otherwise indicated, shall have a non-slip finish (as defined by PCA - Portland Cement Association "Design and Control of Concrete Admixtures") applied in the following manner:

a) Medium Finish: On all surfaces having a pitch of less than 5 percent, Equivalent to a "Medium Finish" term, with at least a 1/16" reveal.

b) Rough Finish: On all surfaces having a pitch greater than 5 percent, Equivalent to a "Heavy Finish" term, with at least a 1/8" reveal.

~~e. Broom Finish: All concrete paving and concrete finishes, and exterior concrete platforms, steps, ramps and other areas requiring non-slip finishes, unless otherwise indicated, shall have a non-slip broom finish (as defined by PCA - Portland Cement Association "Design and Control of Concrete Mixtures") applied in the following manner:~~

~~1) Medium Broom Finish.~~

~~a) 1/16" reveal.~~

~~2) Rough Broom Finish.~~

~~a) 1/8" reveal.~~

~~f.~~e. Aggregate Finish: Apply aggregate finish to selected concrete surfaces as indicated on the drawings.

1) "Washed" Aggregate Finish.

~~g.~~f. Sandblast Finish:

1) "Light Sandblast Finish:" 1/16 inch reveal.

~~2) "Medium Sandblast Finish:" 1/4 inch reveal.~~

~~h. \Stamped Concrete Finish:~~

~~1) Pattern: To be selected by Architect.~~

~~i. Truncated Dome Finish:~~

~~1) Tactile Warning with colored hardener and sealer required to separate the pedestrian way from the vehicle way.~~

2. Applied Finishes:

a. Slab Curing Compound (SCC): Used as a curing compound for exterior slabs on grade with no flooring applications.

b. Clear Floor Hardener Finish (CFH): Used to prevent "dusting," where a light degree of hardness is required to the interior slab finish.

3. Repair finishes (Vertical surfaces):

a. "Sack Finish:" Applied to defective surfaces mixed to the color and consistency required to match the adjacent materials in color and strength.

2.14 SOURCE QUALITY CONTROL

A. Test, Inspection:

1. Inspection of Mix:

a. Quality and quantity of material used shall be subject to continuous inspection by a qualified person. Sampling and testing of cement and aggregates in accordance with Title 24, Part 1, Section 4-335, and CBC Section 1705A, and Table 1705A.3.

b. Maintain sources of material supply constantly after approval of concrete mix.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:

1. Contractor shall inspect bearing soil and report soft or loose unsuitable bearing soil to Architect.
2. Architect will furnish Contractor with corrective measures necessary to remedy field condition.
3. Do not pour concrete until suitable bearing surfaces are achieved.
4. At Engineered Fill, remove soft and loose unsuitable fill and replace with concrete. Cost shall be paid by Contractor.
5. Contractor shall inspect and identify any site conditions and/or design information that prevents the Contractor from complying with the laws, regulations and/or building codes governing ADA access compliance.

3.2 PREPARATION

A. Transportation of Concrete:

1. Handle Concrete from mixer to place of final deposit as rapidly as practical by methods which shall prevent the separation or loss of the ingredients in accordance with ACI 304.3R "Heavyweight Concrete Measuring, Mixing, Transporting, and Placing."
2. Do not move concrete horizontally by means of vibrators.
3. Deposit concrete as nearly as practical at its final position in a manner which, will ensure that required quality is obtained.
4. Chutes shall slope not less than 4 inches and not more than 6 inches per foot of horizontal run.

B. Protection:

1. At old concrete or concrete which has begun to set upon which Concrete is to be placed:

a. Surface shall be level, cleaned of all laitance and rough with solidly embedded large aggregate exposed.

b. Rough surface by chipping entire surface not earlier than 5 days after set, by high pressure hosing (80 pounds per square inch) 2 to 4 hours after placing or by sand blasting with coarse silica sand, roughness amplitude shall be at least 1/4 inch.

c. Not more than 1/2 hour prior to pouring concrete, place 2 inch thick uniform layer of grout on old concrete.

C. Surface preparation:

1. Prepare base materials prior to forming footings and trenches.
2. Remove all water from excavation. Divert flow of water through drains using methods to avoid washing over freshly deposited concrete.
3. Remove hardened concrete, wood chips, shavings and other debris from interior of forms and from reinforcing steel by vacuum process.

a. No wooden ties or blocking shall be left in concrete except where indicated for attachment of other work.

4. Forms shall have been erected, adequately braced, cleaned, sealed, lubricated if required, and bulkheaded where placing is to stop.
5. Any wood forms other than plywood shall be thoroughly water soaked before placing any concrete. The wetting of forms shall be started at least 12 hours before concreting.
6. Reinforcing steel shall have been placed, tied and supported.
7. Coordinate with Specification Section - SOIL TREATMENT before placing any concrete.
8. Embedded work of all trades shall be in place in the forms and adequately tied and braced.
9. Reinforcing steel, at the time the concrete is placed around it, shall be cleaned of scale, mill scale or other contaminants that will destroy or reduce bond.
10. Concrete surfaces to which fresh concrete is to be bonded shall be brush cleaned to remove all dust and foreign matter and to expose the aggregate, and then coated with the bonding adhesive herein specified.
11. Prior to placing concrete for any slabs on grade, the moisture content of the subgrade below the slabs shall be adjusted to at least optimum moisture.
12. No concrete shall be placed until formwork, reinforcement, and embedded items have been approved by the Architect.
    a. Clean forms of all debris and remove standing water.
    b. Thoroughly clean reinforcement and all handling equipment for mixing and transporting concrete.
    c. Concrete shall not be placed against reinforcing steel that is hot to the touch.
13. Provide runways or other approved means for wheeled equipment. Do not wheel equipment over reinforcing or formwork.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.4 INSTALLATION OF BASE

A. Placing of Rock Base:

1. Shall occur after scarification and compaction operations.
2. Preparation of sub-grade and selection and placing of Rock Base subject to continuous inspection and supervision of Geotechnical Engineer.
3. Compact Rock Base to a density of not less than ninety-two (92) percent, but not more than ninety-five (95) percent, in accordance with Test Designation ASTM D 1557 "Test methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lb./sq.ft.)."
    a. Density of each layer of Rock Base shall be tested and verified that it meets required density of Geotechnical Engineer prior to placing any other succeeding layers.
4. Roll Rock Base under interior (and any designated exterior slabs) to smooth surface, free of large or sharp particles.
5. Conduct work to minimize inspection costs.

6. Costs of initial compaction tests shall be borne by the Owner. Contractor shall pay for all re-tests required due to failure of initial tests.

3.5 INSTALLATION OF VAPOR RETARDER

A. General:

1. Follow ASTM E 1643 "Standard Practice and Procedure for Installation of Vapor Retarder used in Contact with Earth Fill Under Concrete Slabs."
2. Level, tamp or roll Earth Fill or Base Material beneath the slab in thickness as indicated on the drawings. Remove all sharp objects that could puncture the Vapor Retarder.
3. Unroll Vapor Retarder over the area where the slab is to be poured, with the longest direction parallel with the direction of the pour.
4. Cut to size, if necessary. Vapor Retarder used shall completely cover the pour area.
5. All joints/seams, both lateral and butt, shall be overlapped six (6) inches and taped using a compatible four (4) inch wide Pressure Sensitive Seaming Tape.
    a. Tape areas shall be free from dust, dirt and moisture to allow maximum adhesion of the pressure sensitive tape.
    b. Vapor Retarder shall overlap six (6) inches and seal to top of all footings and against vertical walls. Provide manufacturer's written recommended sealant.
6. Repair any damaged areas in accordance with manufacturer's written recommendations, and overlap repairs a minimum of six (6) inches in all directions with Vapor Retarder Material, Pressure Sensitive Tape, and Vapor Proofing Mastic.
7. Follow manufacturer's written recommendations for vertical wall applications.

B. Penetrations:

1. Seal all penetrations and check that all pipe, ductwork, rebar, wire penetrations and block-outs are thoroughly sealed.
2. Single Pipe Penetrations may be sealed using pipe boot constructed from the product.
    a. Cut a piece of plastic, width - 12 inches, length - 1 and 1/2 times the circumference of the pipe with scissors; cut slits half the width of the film, and wrap the boot around the pipe; tape onto pipe and completely tape the base to the Vapor Retarder.
3. Multiple pipe penetrations in close proximity and very small pipes may be sealed using Vapor Proofing Mastic.
    a. Cut out small area around pipes; cut a patch of Vapor Retarder extending at least 6 inches past the cut out in all directions; cut X's or small circles in the patch and install over pipes; overlap at least 6 inches and tape; build up 40-60 mils of mastic, or as needed to completely fill all voids between the pipe and Vapor Retarder.
4. No penetration of the Vapor Retarder is allowed except for reinforcing steel and permanent utilities.
    a. In the case that forms must be used vapor stakes should be used to hold forms in place.
    b. Penetrate plastic with stake; treat stake as pipe penetration (see above "penetration" paragraphs; leave stake permanently in concrete; using a power saw, cut stake off above the seal, but below the concrete finished surface; the lower portion of the vapor stake remains in place, permanently plugging the penetration.

3.6 JOINTS

A. General: Construct joints straight, horizontal, true with faces perpendicular to surface plane of concrete and free of "overhangs" or "lips" to line.

B. Construction Joints:

1. Location: as indicated or as approved by Architect and Structural Engineer.
2. Install as to least impair strength of structure, appearance of concrete and shall conform to typical details and in accordance with ACI Standards.

3. Joints between concrete and masonry shall be considered construction joints.
4. Spacing: Pour lengths shall be as follows, unless specifically noted otherwise.
   a. Foundations: 100 feet maximum
   b. Walls: 60 feet maximum
   c. Structural Slabs: 60 feet o.c. maximum
   d. Interior Slabs on grade: 30 feet o.c. maximum
   e. Exterior Slabs on grade: 30 feet o.c. maximum
5. Installation:
   a. Construction joints shall have level tops, vertical sides.
   b. Construction joints shall be thoroughly cleaned and roughened by removing entire surface film and exposing clean aggregate solidly embedded in mortar matrix.
   c. See drawings for doweling and required keys.
   d. Roughen construction joints by any of the following methods:
      1) By sandblasting joint.
      2) By thoroughly washing joint, using a high pressure hose, after concrete has taken initial set. Washing shall be done not less than 2 hours nor more than 4 hours after concrete has been poured, depending upon setting time.
      3) By chipping and wire brushing.
      4) Vertical construction joints need not be roughened
   e. All decisions pertaining to adequacy of construction joint surfaces and to compliance with requirements pertaining to construction joints shall be reviewed with the Architect.
   f. Just before starting new pour, horizontal and vertical joint surfaces shall be dampened (but not saturated).
   g. Before placing regular concrete mix, horizontal and vertical joint surfaces shall be covered with a layer of mortar composed of cement and fine aggregate of same proportions as that used in prescribed mix, but omitting coarse aggregate.

C. Expansion Joints:
1. Location: as indicated or as approved by Architect.
   a. Exterior slabs on grade: locate at walks, curbs, gutters, etc.
      1) Locate at each side of structure/vertical surface, curb transition opposite apron joints, end of curb returns, and back of curb when adjacent to walk.
   b. Interior slabs on grade: Install at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
2. Spacing:
   a. Exterior Slabs on grade: 30 feet o.c. maximum, unless otherwise noted.
   b. Interior Slabs on grade: as indicated.
3. Installation:
   a. Install Expansion Filler in expansion joints.
      1) Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless noted otherwise.
      2) Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface.
      3) Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
      4) "Glue" Expansion Filler to edge of previous pour.
   b. When concrete has taken initial set, the edge of concrete surface shall be rounded by tooling to top of Expansion Filler.
   c. Interrupt reinforcing at all expansion joints.

D. Control Joints (Contraction Joints):
1. Location: as indicated or as approved by Architect.

a. Construction and expansion joints shall be considered as control joints.

2. Spacing:
   a. Exterior Slab on grade: 10 feet o.c. maximum, unless otherwise noted.
   b. Interior Slab on grade: 15 feet o.c. maximum.
      1) Maximum area not to exceed 225 sf.
      2) Maximum length to width not to exceed 1 to 1 1/2 ratio.
      3) Conform to bay spacing wherever possible (at column centerlines, half bays, third bays, etc).
3. Installation: Form weakened-plane control joints, sectioning concrete into areas as indicated.
   a. Use saw cuts 1/8 inch wide by 1/4 of slab depth, or tooled joints with rounded edges 1/8 inch wide by 1/4 of slab depth, unless specifically noted otherwise.
   b. Control joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing without dislodging aggregate and with no spalling of edges on either side of the joint.
   c. Slab reinforcing need not be terminated at control joints.

3.7 CONCRETE PLACEMENT

A. Placing of Concrete - General:
1. All concrete shall be placed under direct observation of the Owner's Inspector.
2. Notify Owner's Inspector not less than forty-eight (48) hours prior to pouring of first concrete.
3. Place concrete in accordance with ACI 304.3R "Heavyweight Concrete Measuring, Mixing, Transporting, and Placing."
4. Do not place Concrete outside of regular working hours except to complete work already started.
5. Do not use Concrete which has been mixed for a period longer than one and one-half (1-1/2) hours or which has started to stiffen or set.
6. Re-mixing on concrete, which has started to set, shall not be permitted.
7. Pouring of concrete shall be a continuous operation until the completion of the Section or Panel in accordance with ACI 304.3R "Heavyweight Concrete Measuring, Mixing, Transporting, and Placing."
8. Consolidation:
   a. Concrete shall be thoroughly compacted and worked to all points with solid continuous contact to forms and reinforcement to eliminate air pockets and honeycombing.
   b. Power vibrators shall be used immediately following pour.
   c. Spading by hand, hammering of forms or other combination of methods will be allowed only where permitted by Architect.
   d. In no case shall vibrators be placed against reinforcing steel or used for extensive shifting of deposited fresh concrete.
   e. Provide and maintain standby vibrators, ready for immediate use.
9. Keep a record of times, dates and locations of all concrete placing operations for the duration of the project. Record shall be available to Architect and Owner's Inspector at all times.
10. In no case shall concrete be poured into an accumulation of water ahead of pour.
11. If any concrete operation, once planned, can not be completed in a continuous operation, placement shall stop at temporary bulkheads located where resulting construction joints will least impair the strength of the structure. The location of construction joints shall be as shown on the drawings, or as approved by Architect.
12. Hot Weather Concreting: Unless otherwise directed by the Architect, perform all work in accordance with ACI 305.1 "Specification for Hot Weather Concreting" when air temperature rises above 75 degrees F and the following:

a. Mixing Water: Keep water temperature as low as necessary to provide for the required concrete temperature at time of placing. Ice may be required to provide for the design temperature.
b. Aggregate: Keep aggregate piles continuously moist by sprinkling with water.
c. Temperature of Concrete: The temperature of the concrete mix at the time it is being placed in the forms shall not exceed 85 degrees F.
    1) The method employed to provide this temperature shall in no way alter or endanger the design mix or the design strength required.
    2) Dampen subgrade and formwork before placing concrete.
    3) Remove all excess water before placing concrete.
    4) Keep concrete continuously wet when air temperature exceeds 85 degrees F for a minimum of 48 hours after placing concrete.
d. Protection: Minimize evaporation from concrete in place by providing shade and windbreaks. Maintain such protection for 14 days minimum.

13. Cold Weather Concreting: Follow recommended ACI 306R "Cold Weather Concreting" procedures when air temperature falls below 40 degrees F, as approved by Architect.
    a. Concrete placed in freezing temperature shall have a temperature of not less than 50 degrees F.
    b. Maintain this temperature for at least 7 days.
    c. No chemicals or salts shall be used to prevent freezing and no accelerating agents shall be used without prior approval from Architect.
14. Concrete shall not be placed if sand overlying the vapor retarder barrier has been allowed to attain a moisture content greater than 5 percent due to precipitation or excessive watering.

B. Placing of Concrete at Footings, Curbs~~Walls, Columns~~, etc.:
1. Concrete shall be placed in layers not to exceed twenty-four (24) inches in depth, and shall be thoroughly compacted.
    a. Wait forty minutes before placing next layer.
    b. Re-vibrate six (6) inches into previous lift before next lift is added.
    c. Locate top of lift at or below top of wall opening.
2. Use openings in forms, elephant trunks or other approved methods to prevent accumulation of concrete on forms and reinforcement above the level of pour.
    a. Unconfined free falls shall not exceed five (5) feet.
3. Where placing or consolidation is restricted by close assemblage of reinforcing and/or forms use a Modified Mix Concrete with smaller aggregate and/or pour 3 inches of neat grout into form prior to regular mix.
4. Concrete shall not be flowed horizontally along forms.

C. Placing of concrete at slab on grade:
1. Slabs on grade shall not be poured until the sub-grade has been thoroughly compacted and properly prepared, complete with vapor retarder or barrier, nor until reinforcement and inserts are securely fastened in place.
    a. Sub-grade above and below vapor retarder where installed resilient flooring products or rubber/vinyl-backed products are proposed to be installed shall not be moistened prior to pouring concrete.
2. No greater area shall be poured at one time than can be properly finished without checking.
3. Slabs on grade shall be laid out in a checkerboard pattern when applicable. Pour and allow alternate slabs to set.
    a. Fill out balance of checkerboard pattern with subsequent pour.
4. Concrete shall be poured as dry as possible, consistent with good workmanship.

a. Water shall not be added to mix to improve workability without approval of the Architect.

5. Concrete shall be compacted by hand tamping and by mechanical vibration.
   a. After the concrete is thoroughly compacted, the surface shall be screeded off, any surface water removed an finish applied as specified.
6. The Contractor may, on approval of DSA and the Architect, use a Finish Enhancing Admixture (High Range Water Reducer) in accordance with Article Titled MATERIALS.

D. Placing of concrete by pumps:
1. If pumps are used to place concrete, the fines (3/8" and smaller) shall not exceed 45 percent of the total volume of aggregate. Standby equipment must be provided to insure completing pours to planned cutoffs.
2. Pumps shall handle concrete at a uniform rate without bleeding or segregation of aggregates. Concrete from end of the hose shall have a free fall not to exceed four (4) feet. Aluminum pipe shall not be used to transport pumped concrete.

3.8 INSTALLATION OF SHRINKAGE-RESISTANT GROUT

A. Installation of nonshrink grout or drypack: Install under base plates immediately after erection of structural steel.
1. General: Ram in thin layers, using a short length of ram, the free end of which shall be struck with a heavy hammer or mallet, several blows for each layer, to compact the mixture. When completed, the exposed drypack shall show slight indication of moisture.
2. Curing: Cure with a curing compound or with moisture-retaining barrier kept wet.

3.9 APPLICATION

A. Finishes application:
1. Screed, consolidate, and level concrete slabs prior to any Finishes.
2. Tooled Finishes:
   a. Scratch finish:
      1) After screeding, consolidating, and leveling, roughen surface before final set with stiff brushes, brooms, or rakes.
   b. Float finish:
      1) After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating.
      2) Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both.
      3) Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power units.
      4) Finish surfaces to tolerances indicated.
      5) Cut down high spots and fill low spots.
      6) Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
   c. Trowel finish:
      1) After floating, begin first trowel-finish operation using a power-driven trowel.
         a) Begin final troweling when surface produces a ringing sound as trowel is moved over surface.
         b) Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances indicated.

c) Grind smooth any surface defects that would telegraph through applied floor covering system.

2) Where thin set ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.

3) Apply a non-slip "Sweat Trowel" finish (tight circular motion approved by the Architect) to exterior slabs in the final troweling operation.

~~d. Broom finish:~~

~~1) Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route for the indicated broom finish.~~

~~2) Medium Broom Finish: On all surfaces having a pitch of less than 6 percent.~~

~~3) Rough Broom Finish: On all surfaces having a pitch of more than 6 percent.~~

~~e.~~d. Aggregate Finishes:

1) "Washed" Aggregate Finish method:

a) When concrete has cured sufficiently to hold aggregate, but soft enough to remove surface cement, wash and brush surface to expose aggregate.

b) Quality of finish shall be in accordance with approved mock-up.

3. Sandblast Finishes:

a. "Light Sandblast Finish" by the Abrasive Blast Method:

1) Miscellaneous concrete structures as indicated on the drawings.

2) Perform abrasive blasting after compressive strength of concrete exceeds 2000 psi. Coordinate with formwork removal to ensure that surfaces to be abrasive blasted are treated at same age for uniform results.

3) Surface Continuity: Perform abrasive-blast finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work. Maintain required patterns or variances in depths of blast to match design reference sample or mockup.

4) Abrasive blast corners and edges of patterns carefully, using backup boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure, and blasting techniques required to match design reference sample or mockup.

5) Sufficient to expose fine aggregate with occasional exposure of coarse aggregate as follows:

a) Maximum Reveal: 1/16 inch.

b) Cracks, voids, protrusions, spalls, or non-uniform color or texture will not be acceptable.

~~b. "Medium Sandblast Finish" by the Abrasive Blast Method:~~

~~1) Miscellaneous concrete structures as indicated on the drawings.~~

~~2) Perform abrasive blasting after compressive strength of concrete exceeds 2000 psi. Coordinate with formwork removal to ensure that surfaces to be abrasive blasted are treated at same age for uniform results.~~

~~3) Surface Continuity: Perform abrasive-blast finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work. Maintain required patterns or variances in depths of blast to match design reference sample or mockup.~~

~~4) Abrasive blast corners and edges of patterns carefully, using backup boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle~~

~~pressure, and blasting techniques required to match design reference sample or mockup.~~

~~5) Sufficient to expose fine aggregate with occasional exposure of coarse aggregate as follows:~~

~~a) Maximum Reveal: 1/4 inch.~~

~~b) Cracks, voids, protrusions, spalls, or non-uniform color or texture will not be acceptable.~~

4. Truncated Dome Finishes:
   a. Cast-In-Place Replaceable Truncated Domes Mat:
      1) Installation: Install into freshly poured concrete per manufacturer's instructions.
         a) Tamp and vibrate into freshly poured concrete to ensure that there are no voids or air pockets.
         b) Field level flush to the adjacent concrete surfaces to permit proper water drainage and eliminate tripping hazards.
      2) Cut and set into size and configuration as indicated.
         a) Minimize any catilever effect when cutting between successive embedment ribs.
         b) Top of the body shall be fully seated and flush with adjacent concrete substrate.
      3) Orient domes such that the rows of inline trucated domes are parallel with the direction of the ramp.
         a) When multiple mats are used, the truncated domes shall be aligned between the tactile warning surfaces and throughout the entire tactile warning surface installation.
      4) Do not create voids between the underside of the tile and the concrete.
         a) No walking, leaning or external forces shall be placed during and after installation and the concrete curing stage.
      5) Remove protective plastic sheeting within twenty four (24) hours of installation.
      6) Clean mat by method specified by manufacturer.
      7) If requested, clean mats not more that four (4) days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project.
      8) All traffic is prohibited until adhesive and sealant have cured.
5. Applied Finishes:
   a. Slab Curing Compound Finish (SCC):
      1) Apply Clear Slab Curing Compound Sealer Finish in accordance with manufacturer's written recommendations, and in exterior areas only as indicated by the Contract Documents.
   b. Clear Floor Sealer Finish (CFS):
      1) Apply Clear Floor Sealer Finish in accordance with manufacturer's written recommendations, and in areas as indicated by the Contract Documents.
   c. Clear Floor Hardener Finish (CFH):
      1) Apply Clear Floor Hardener Finish in accordance with manufacturer's written recommendations, and in areas as indicated by the Contract Documents.
6. Repair Finishes:
   a. Sack Finish: Use only enough water as required for handling and placing.

1) Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than one (1) inch.
   a) Make edges of cuts perpendicular to the concrete surface.
   b) Thoroughly clean, dampen with water, and brush-coat the area to be patched with a bonding agent.
   c) Place patching mortar before bonding agent has dried.
2) For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color.
   a) Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching.
   b) Compact mortar in place and strike-off slightly higher than surrounding surface.

B. Concrete curing and protection:
1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
   a. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material.
   b. Apply according to manufacturer's written instructions after screeding and bull floating, but before power floating and troweling.
2. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than ten (10) days.
3. Formed Surfaces:
   a. Wet forms immediately after pouring.
   b. Keep forms and exposed surfaces wet until forms are removed.
   c. Keep all surfaces wet after forms are removed for ten (10) days after placement of Concrete.
4. Concrete Slab Curing Methods:
   a. One spray coat of clear curing compound.
      1) Agitate curing compounds thoroughly by Mechanical means continuously during use and spray or brush uniformly in accordance with manufacturer's written recommendations.
      2) Not applicable for:
         a) Slabs designated for Adhesively Applied Floor Coverings.
         b) Slabs designated for Resinous Flooring on top of concrete slab.
         c) Slabs designated for Polished Concrete Finishing.
   b. Curing paper:
      1) Anchor the paper or film securely and seal all edges in such a manner as to prevent moisture escaping from concrete.
      2) Protect all exposed surfaces with "Curing Paper." Curing Paper shall be kept moist.
      3) Contractor shall be responsible for protection of finished concrete against injury by rain, cold, vibration, animal tracks, marking by visitors, vandalism, etc.
      4) Required for the following:
         a) All interior concrete slabs.

3.10 CONSTRUCTION TOLERANCE

A. Exterior Site Improvements:

1. Placement of all concrete shall not exceed 0.02 feet variance from designated grades.
2. Surface variation of all concrete slabs shall not exceed 0.01 foot in 10 feet.
3. Construction of all concrete subject to ADA access compliance, including Accessible Path of Travel, curb returns, parking stalls and unloading areas, barrier free amenities and / or other applicable site improvements shall conform to the Americans with Disabilities Act, California Title 24 and the California Building Code, regardless of any construction tolerances. Examples of minimum and maximum limits related to ADA access compliance include, but are not limited to:
   a. Accessible Path of Travel cross-slope shall not exceed 2 percent.
   b. Accessible Path of Travel longitudinal slopes shall not exceed 5 percent.
   c. Ramp longitudinal slopes shall not exceed 8.33 percent.
   d. Walks shall not have less than 48 inches in unobstructed width.

   Maintain all grades and slopes throughout construction and until Notice of Completion has been filed.

B. Building Slabs:
1. General: All surface variations of slabs shall be less than 1/8 inch in 10 feet. Uniformly slope slab surfaces to drains where indicated on the drawings.
2. Typical Building Slabs:
   a. Flatness: SOV, greater than FF 35, MLV, greater than FF 24.
   b. Levelness: SOV, greater than FL 25, MLV, greater than FL 17.
3. Polished Concrete Flooring Slabs:
   a. Flatness: SOV,: greater than FF 45, MLV,: greater than FF 30.
   b. Levelness: SOV,: greater than FL 35, MLV,: greater than FL 24.
4. FF (Floor Flatness) and FL (Floor Levelness): The Contractor shall measure according to ASTM E 1155 "Standard test method for Determining FF (Floor Flatness) and FL (Floor Levelness) Numbers," within twenty-four (24) hours of the pour.
   a. Cut down high spots, and fill low spots, and adjust pour techniques to achieve floor tolerances specified.
   b. Contractor shall pay for and have a Certified Report in writing from an Independent Testing Agency that concrete substrates requiring FF and FL only are constructed to the specified tolerances, and are ready for floor coverings that require FF and FL.
   c. SOV = Specified Overall Value.
   d. MLV = Minimum Local Value.
   e. Tolerances are required by the Polished Concrete Finishing Industry as an adequate substrate for their mechanized polishing machines to achieve any desired sheens on concrete surfaces.
   f. Required tolerances of concrete surface substrates for specific flooring systems:
   g. Polished Concrete: Refer to Specification Section - POLISHED CONCRETE FINISHING.

3.11 REPAIR/RESTORATION

A. Minor Defects:
1. Minor defects in concrete shall mean any of the following:
   a. Pour joints, voids, rock pockets, tie holes, etc. where strength, and durability is not adversely affected.
   b. Shrinkage Cracks where slabs are not exposed or where appearance is not important
   c. Minor defects of pour joints, voids, rock pockets, tie holes, etc.
   d. Immediately after removing forms, inspect all concrete surfaces. Patch any pour joints, voids, rock pockets, tie holes, etc., as soon as possible, but not until the defect has been examined by the Architect.

e. Chip away defective areas to a minimum depth of one inch, with edges perpendicular to surface. Clean area to be patched of all laitance.
f. Coat area to be patched with Bonding Agent. Patch with Mortar mixed with Bonding Agent thoroughly compacted into place and screeded off to leave the patch slightly higher than the surrounding surface. After at least one hour finish patch to match the adjoining surface. Cure patch by application of curing compound or by wetting for seven (7) days.
g. Fill tie holes solid with mortar after cleaning and thoroughly wetting. Fill through holes by means of a plunger-type grease gun. See Specification Section - CONCRETE FORMWORK, Part 3 Article titled "INSTALLATION," and the paragraph titled "Indentations" for exception.
h. Remove fins and rough surfaces from all exposed concrete.

2. Minor defect of shrinkage cracks:
   a. After entire slab is finished and fully cured, shrinkage cracks larger than 1/32 inch wide shall be filled with cement grout and struck off level with surface.

B. Serious Defects:

1. Serious defects in concrete shall mean any of the following:
   a. Concrete not meeting 100 percent of the specified 28 day compressive strength.
   b. Concrete exhibiting rock pockets, voids, spalls, streaks, cracks, exposed reinforcing to extent that strength, durability, or appearance is adversely affected.
   c. Concrete significantly out of place, line or level.
   d. Concrete not containing the required embedded items.
   e. Shrinkage Cracks where slabs are exposed and appearance is important.
   f. Concrete where patching does not satisfactorily restore quality and appearance of surface.
2. Upon determination that concrete strength is defective:
   a. Should cylinder tests fall below minimum strength specified, concrete mix for remainder of work shall be adjusted to produce required strength. Core samples shall be taken and tested from cast-in-place concrete where cylinders and samples indicate inferior concrete with less than minimum specified strength.
   b. Cores of hardened concrete shall be taken and tested in accordance with ASTM C 39 "Test method for Compressive Strength of Cylindrical Concrete Specimens" and ASTM C 42 "Test method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete." Number and location of such cores shall be subject to the approval of Architect.
   c. Cost of core sampling and testing will be paid for by the Contractor.
   d. "500 psi" and "85 percent" reduction in ACI 318 "Building Code requirements for Structural Concrete and Commentary," Section 26.12.4 will not justify low cylinder tests.
   e. If core tests indicate that concrete is below the strength specified, the concrete shall be deemed defective, and shall be removed and replaced without additional cost to the Owner.
3. Major defect of shrinkage cracks.
   a. After entire slab is finished and fully cured, unsightly shrinkage cracks shall be repaired in a manner satisfactory in appearance to the Architect. If this cannot be accomplished, concrete shall be considered defective.
4. Upon determining that concrete surface is defective:
   a. Contractor may restore concrete to acceptable condition by cutting, chipping, pointing, patching, grinding, if this can be done without significantly altering strength of structure.

b. Permission to patch defective areas will not be considered a waiver of the right to require removal if patching does not, in the opinion of the Architect, satisfactorily restore quality and appearance.

c. If patching does not restore concrete to specified quality and appearance, the concrete shall be deemed defective, and shall be removed and replaced without additional cost to the Owner.

d. No repair work shall begin until concrete has been examined and procedures have been reviewed by the Architect and Structural Engineer and approved by **DSA**.

C. Cost of repairing shall be borne by the Contractor.

3.12 FIELD QUALITY CONTROL

A. Contractor's Field Quality Control:

1. Contractor shall protect slabs receiving flooring products from excess moisture after the curing process, removing excess moisture after rains, broken water pipes, etc., to ensure that the monolithic slabs are dry enough for application of flooring products. When all spaces have been enclosed, acclimate the building as soon as possible with the building's own mechanical heating and cooling system, and other outside devices as required to properly prepare the monolithic slabs for flooring installation.

a. The test sites for the RH Tests shall be at the same room temperature and humidity expected during normal use. If this is not possible, then the test site conditions should be 75 degrees F (plus or minus 10 degrees F) and 50 percent relative humidity (plus or minus 10 percent relative humidity) 48 hours prior to, and during testing.

2. Contractor shall maintain temperature and humidity in a manner not deleterious to the flooring materials installed until the Owner assumes occupancy.

B. Site Tests:

1. Compression Tests:

a. Testing Agent will make a set of four (4) concrete compression cylinders from each fifty (50) cubic yards or every 2,000 sq.ft. of surface area for slabs and walls per CBC Section 1905A.1.17 of each class of concrete, or fraction thereof, placed each day, and cure and test concrete compression cylinders in accordance with ASTM C 31 "Practice for Making and Curing Concrete Test Specimens in the Field," ASTM C 39 "Test method for Compressive Strength of Cylindrical Concrete Specimens," ACI Section 26.12 and ASTM C 172 "Practice for Sampling Freshly Mixed Concrete."

1) From each concrete compression cylinder set, Testing Agent shall test one cylinder at age seven (7) days, test two cylinders at age twenty-eight (28) days per ACI 318 "Building Code requirements for Structural Concrete and Commentary," Section, 26.12 and hold one cylinder for test only if directed by the Architect.

2) Cylinders shall be identified as to area from which they were taken and show the date and time of day they were prepared.

b. Testing Agent shall also test Grout and Mortar as required for compliance to Compression Requirements specified.

C. Inspection:

1. Project Inspector shall inspect placement of concrete and grout.

D. Manufacturer's Field Services:

1. Contractor shall notify Vapor Retarder manufacturer at least one week prior to the Pre-Construction Conference regarding the Vapor Retarder installation, and will schedule subsequent visits at the appropriate times with at least one week's notice to ensure proper installation of the Vapor Retarder in accordance with the Manufacturer's Written Instructions.

2. Manufacturer shall provide a written Inspection and installation certification to the Architect that full compliance with the manufacturer's written instructions were followed and adhered to prior to covering with concrete.

3.13 CLEANING

A. The top of all concrete foundations receiving concrete masonry units shall be washed free of all laitance and loose concrete, and roughened to a roughness amplitude of 1/4".

B. Remove all debris, excess materials, tools, and equipment resulting from or used in this operation at completion of work.

END OF SECTION

SECTION 03 35 10 – POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely provide polished concrete finishing materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 03 11 01 CONCRETE FORMWORK
   4. 03 30 00 CAST-IN-PLACE CONCRETE
   5. 07 92 00 SEALANTS
   6. 09 65 10 RESILIENT BASE AND ACCESSORIES
   7. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with the following standards:
      a. ACI American Concrete Institute.
         1) ACI 302.1R "Guide for Concrete Floor and Slab Construction."
      b. ASTM American Society of Testing Materials.
      c. NFSI National Floor Safety Institute.
         1) NFSI Test Method 101-A "Standard for Evaluating High-Traction Flooring Materials, Coatings, and Finishes."
      d. RILEM Reunion Internationale des Laboratoires D’Essais et de Recherches sur les Materiaux et les Consructions.
         1) RILEM Test Method 11.4 "Standard Measurement of Reduction of Moisture Penetration Through Horizontal Concrete Surfaces."

1.3 DEFINITIONS

A. New Concrete: Concrete poured as part of this Project. Refer to Specification Section - CAST-IN-PLACE CONCRETE.

B. Existing Concrete: Any slab existing (or poured) prior to this Project.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: It is the intention of this section and the drawings to form a guide for a complete system. Any items not specifically noted but necessary for a complete system shall be provided under this section.
   1. Fire Rating: Class "A" Fire Rated when tested in accordance with ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials."
   2. Abrasion Resistance:

a. ASTM C 779 "Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces," Method A, high resistance, no more than 0.008 inch (0.20 mm) wear in 30 minutes.

3. Reflectivity: Increase of 35 percent as determined by standard gloss meter.
   a. ASTM E 430, "Standard Test Methods for measurement of Gloss or High-Gloss Surfaces by Abridged Goniophotometry."
4. Waterproof Properties: RILEM Test Method 11.4, 70 percent or greater reduction in absorption.
5. High Traction Rating after Polishing: NFSI 101-A, non-slip properties.
   a. Static Coefficient of Friction: For Polished Concrete Floors, all walkway surfaces shall comply with the ADA Requirements and the following minimum values as determined by testing identical products per ASTM C 1028 "Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method:"
      1) Level Surfaces: Minimum 0.6.
      2) Ramps: Minimum 0.8.

B. Design Requirements:
1. Verify Hardened Concrete Properties:
   a. Minimum new concrete compressive strength Minimum 3,500 psi required.
   b. Floor slab to be polished is Normal Weight Concrete.
      1) That no Lightweight Aggregate Concrete is used in the mix.
      2) That no Air Entrained Concrete Admixture is used in the mix.
2. Verify Placement Properties:
   a. That the natural concrete slump of concrete mix was between 4-1/2 inches – 5 inches.
   b. Flatness and Levelness Requirements in accordance with ASTM E 1155 "Standard test method for Determining FF (Floor Flatness) and FL (Floor Levelness) Numbers:"
      1) Flatness: SOV, greater than FF 45, MLV, greater than FF 30.
      2) Levelness: SOV, greater than FL 35, MLV, greater than FL 24.
3. Verify that the finish of the concrete slab was accomplished with Hard-Steel Trowels, and that the minimum passes for the slab was at least three (3) passes, and that there were no burn marks.
   a. Finish shall comply with ACI 302.1R, Class 5 Floor.
4. Verify that the Curing Options used for the floor slab were at least one of the following:
   a. Sheet membrane (ASTM C 171 "Specification for Sheet materials for Curing Concrete").
      1) Polyethylene Film is NOT ALLOWED.
   b. Damp Curing Process:
      1) Seven Day Cure minimum.
5. Verify that no Spray-On "Cure and Seal" curing compounds were used.

1.5 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
1. Product Data.
   a. Submit product data for specified products.
   b. Material Safety Data Sheets (MSDS).
   c. Standard Colored Concrete dyes or stains for selection by the Architect.
   d. Joint and Crack filler color range for selection by the Architect.

2. Shop Drawings.
    a. Typical layout showing the colored concrete treatment areas per color choice.
    b. Typical layout including dimensions and floor grinding schedule.
    c. Plan view of floor and joint pattern layout.
3. Quality Assurance/Control Submittals:
    a. Test Reports:
        1) Submit three (3) copies of reports.
            a) Certified test reports showing compliance with specified performance characteristics and physical properties as cited in Design Requirements article.
            b) Manufacturers Field Reports indicating that the manufacturer has read and instructed the installer of the proper procedures in regards to the Manufacturer's installation instructions prior to the start of the Polishing Operations.
            c) Manufacturers Field Reports indicating Installers compliance with Manufacturer's Installation Instructions at the end of the Polishing Operations.
    b. Certificates:
        1) Submit three (3) copies of certificates.
            a) Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria, and physical requirements.
            b) Letter of certification from the National Floor Safety Institute confirming the system has been tested and passed phase Two Level of certification when tested by Method 101-A.
            c) Current contractor's certificate signed by manufacturer declaring contractor as an approved installer of polishing system.
    c. Manufacturer's Written Instructions:
        1) Submit three (3) copies of manufacturer's written procedural instructions.
4. Closeout Submittals in accordance with the following:
    a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
    b. Record Documents in accordance with Specification Section - RECORD DOCUMENTS.
    c. Warranty in accordance with Specification Section - WARRANTIES.

1.6 QUALITY ASSURANCE

A. Qualifications:
1. Installer Qualifications:
    a. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
    b. Installer trained and holding current manufacturer's certification for Polished Concrete Finish installation.
        1) Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and data sheets.
        2) Use only manufacturer certified Polished Concrete Finishing installers.
        3) Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.

2. Manufacturer/Supplier Qualifications:
    a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS.

C. Mockups:
1. Mock-Up Size: One 100 ft^2 sample panel at jobsite at location as directed under conditions similar to those which will exist during actual placement.
    a. Mockups shall be located in a space that is not visible to the public, such as ancillary spaces, maintenance rooms, mechanical rooms, or rooms that will receive carpet. Refer to Finish Schedule.
    b. Mockup grinding grades GGL II thru III for each color and finish for the Architect to select.
    c. Show:
        1) Several intensities of colors for selection by Architect. More intense dye concentrations may be required to achieve color.
        2) Colors immediately adjacent to show workmanship in control of pattern.
        3) Partial sample of graphic at 100% scale.
        4) Partial sample of pattern: filled joints, colored, scored.
2. Allow 24 hours for inspection of mock-up before proceeding with work.
3. Mock-up will be used to judge workmanship, concrete substrate preparation, operation of equipment, material application, polished concrete shine, color, and proposed protection methods during construction.
    a. Coordinate with Specification Section – CAST-IN-PLACE CONCRETE for Integral Color applications and color selections.
4. Remove mock-up and dispose of materials when no longer required and when directed by the Architect.

D. Meetings:
1. New Concrete: Schedule prior to the concrete pour.
    a. Coordinate the work with other work being performed.
    b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements, such as:
        1) Environmental requirements.
        2) Concrete mix requirements.
        3) Concrete curing requirements.
        4) Concrete protection requirements.
2. Pre-Installation: Schedule prior to the start of work.
    a. Coordinate the work with other work being performed.
    b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements, such as:
        1) Environmental requirements.
        2) Scheduling and phasing of work.
        3) Coordinating with other work and personnel.
        4) Protection of adjacent surfaces.
        5) Surface preparation.
        6) Repair of defects and defective work prior to installation.
        7) Cleaning.

8) Preparation and application of the Stains or Dyes to the floor areas in compliance with the floor coloring plan.
9) Application of liquid hardener, densifier.
10) Installation of polished floor finishes.
11) Protection of finished surfaces after installation.

3. Progress: Scheduled by the Contractor during the performance of the work.
   a. Review for proper installation of work progress.
   b. Identify any installation problems and acceptable corrective measures.
   c. Identify any measures to maintain or regain project schedule if necessary.
4. Completion: Scheduled by the Contractor upon proper completion of the work.
   a. Inspect and identify any problems, which may impede issuance of warranties or guaranties.
   b. Maintaining installed work until the Final Inspection by the Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
   1. Products shall be handled in such a manner as to assure that they are free from damage.
   2. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
   3. Delivery:
      a. Deliver materials in manufacturer's original packaging with identification labels and seals intact.

B. Acceptance at Site:
   1. Damaged products will not be accepted.
   2. Products must be in manufacturer's original unopened containers with labels indicating brand name, product number, and grade.

C. Storage and protection:
   1. Storage and Protection:
      a. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
         1) Store under cover in a cool place with temperatures between 40 and 90 degrees F. Protect from freezing. Don’t stack packages or buckets more than three high.
      b. Protect concrete slab prior to stains, dyes, and polishing:
         1) Protect from petroleum stains during construction.
         2) Diaper hydraulic power equipment.
         3) Restrict vehicular parking.
         4) Restrict use of pipe cutting machinery.
         5) Restrict placement of reinforcing steel on slab.
         6) Restrict use of acids or acidic detergents on slab.
         7) Restrict use of adhesives on slab.
   2. Waste Management and Disposal:
      a. Remove from site and legally dispose of packaging materials.

1.8 PROJECT CONDITIONS

A. Environmental requirements:
   1. Dust control: Perform work in a manner as to minimize the spread of dust and flying particles.

2. Rain: The work under this section shall not be started or maintained under threat of rain unless the work is not affected by the rain.
3. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting topping performance.
4. Temporary Lighting: Provide a minimum 200W light source, placed 8 feet above floor surface, for each 425 sq ft of floor being finished.
5. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.
6. Verify that the concrete surface meets the Design Requirements within this specification.

B. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

1.9 SEQUENCING AND SCHEDULING

A. Sequence with Other Work: Comply with manufacturer's written recommendations for sequencing construction operations. It is imperative that this work be done before any framing is in place upon the slab, otherwise the consistency of the finish would be compromised if done at a later date within the construction operations.
1. Grinding:
   a. Identify the areas of existing or new slab construction, and coordinate the Grinding Grade Level required for each area.
2. Integral Color and Polishing:
   a. Provide integral color within the concrete mix at the time of pouring the slab, then allow a minimum of 28 days (but no more than 60 days) before the polishing operations begin.
3. Dye and Polishing:
   a. Provide dye operations in accordance with manufacturer's written instructions before the polishing operations begin.
4. Stain and Polishing:
   a. Provide stain operations in accordance with manufacturer's written instructions before the polishing operations begin.

1.10 WARRANTY

A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
1. In accordance with manufacturer's written standard warranty:
   a. Warranty Period: One (1) Year.

C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES
   a. Warranty Period: One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified Polishing Concrete Finishing product manufacturer:
   a. L & M CONSTRUCTION CHEMICALS: "PermaShine System."
   b. Acceptable alternative manufacturers:
      1) ADVANCED FLOOR PRODUCTS: "RetroPlate 99."
      2) AMERIPOLISH
      3) DAYTON SUPERIOR: "Diamond Polish Floor Systems."
      4) DIAMATIC: "Ultraflor."
      5) THE BOMANITE CO.: "Manufacturer's Standard."
      6) PERFECT POLISH: "Natural Wonder Floor System."
      7) SCHOFIELD: "Formular One."
      8) W.R.MEADOWS: "Indurashine."
2. Specified Concrete Dye product manufacturer:
   a. L & M CONSTRUCTION CHEMICALS, INC.: "Vivid Concrete Dyes."
   b. Acceptable alternative manufacturers:
      1) ADVANCED FLOOR PRODUCTS: "Manufacturer's Standard."
      2) AMERIPOLISH: "Manufacturer's Standard."
      3) DIAMATIC: "Manufacturer’s Standard."
      4) DAYTON SUPERIOR: "Pro Aqua Vivid Dyes."
      5) THE BOMANITE CO.: "Pantene Teres Dyes."
      6) PERFECT POLISH: "Manufacturer's Standard."
      7) SCHOFIELD: "Formula One" Liquid Dye Concentrate.
3. Specified Concrete Stain product manufacturer:
   a. DAYTON SUPERIOR: "Pro Patina Stains."
   b. Acceptable alternative manufacturers:
      1) ADVANCED FLOOR PRODUCTS: "Manufacturer's Standard."
      2) DIAMATIC: "Manufacturer's Standard."
      3) L & M CONSTRUCTION CHEMICALS: "Manufacturer's Standard."
      4) THE BOMANITE CO.: "Manufacturer's Standard."
      5) PERFECT POLISH: "Manufacturer's Standard."
4. Specified Hardener / Densifier product manufacturer:
   a. L & M CONSTRUCTION CHEMICALS, INC.: "FGS Hardener Plus."
      1) Acceptable alternative product manufacturers:
         a) AMERIPOLISH "3D HS" & "SR2."
         b) THE BOMANITE CO.: "StabilizerPro."
         c) THE BOMANITE CO.: "VitraFinish."
         d) DYAMATIC: "Flor-Sil" Densifier and "Flor-Finish" Finish
         e) W.R.MEADOWS: "Bellatrix" or "Liqui-Hard."
5. Specified Oil Repellent Sealer product manufacturer:
   a. L & M CONSTRUCTION CHEMICALS, INC.: "Petrotex."

1) Acceptable alternative product manufacturers:
a) THE BOMANITE CO.: "VitraFinish."

6. Specified Joint Filler product manufacturer:
a. L & M CONSTRUCTION CHEMICALS, INC.: "Joint Tite 750."
1) Acceptable alternative product manufacturers:
a) EUCLID CHEMICAL: "Quick Joint 200."

7. Specified Protective Cover product manufacturer:
a. RAM BOARD: "Ram Board."
1) Acceptable alternative product manufacturers:
a) McTECH GROUP: "EZcover."

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Products:
1. Integral Color: See Specification Section – CAST-IN-PLACE CONCRETE.
2. Water shall be potable.
3. Concrete Dyes:
a. Provide fast-drying dye, packaged in premanufactured units ready for mixing with VOC Exempt Solvent, formulated for application to polished cementitious surfaces.
1) Provide manufacturer’s Standard Color Options for selection by Architect.
4. Concrete Stains:
a. Water-Based, penetrating, reactive stains, that creates a chemical reaction within the concrete substrate, and formulated for application to polished concrete surfaces.
1) Provide manufacturer’s Standard Color Options for selection by Architect.
2) No "Acid Etching Stains" allowed.
5. Joint Filler: Semi-rigid, 2-component, self-leveling, 100% solids, rapid curing, polyurea control joint and crack filler with Shore A 80 or higher hardness.
6. Hardener / Densifier: Water based, odorless liquid, VOC compliant, environmentally safe chemical hardening solution leaving no surface film.
7. Oil Repellent Sealer: Ready to use, silane, siloxane and fluoropolymers blended water based solution sealer, quick drying, low-odor, oil and water repellent, VOC compliant and compatible with chemically hardened floors.

2.3 FINISHES

A. Gloss Reading Standards, in accordance with ASTM E 430, "Standard Test Methods for measurement of Gloss or High-Gloss Surfaces by Abridged Goniophotometry".
1. GL-1 (Matte) 50 grit.
a. Gloss Reading: 2.
b. Maximum Level of Slip Resistance (COF): 0.747.
c. Mohs Hardness Factor Range: 4.5.
2. GL-2 (Matte) 120 grit.
a. Gloss Reading: 4.
b. Maximum Level of Slip Resistance (COF): 0.733.
c. Mohs Hardness Factor Range: 5.0.
3. GL-3 (Matte) 220 grit.
a. Gloss Reading: 7.

b. Maximum Level of Slip Resistance (COF): 0.76.
c. Mohs Hardness Factor Range: 5.5.

4. GL-4 (Low Sheen) 400 grit.
   a. Gloss Reading: 23-25.
   b. Maximum Level of Slip Resistance (COF): 0.803.
   c. Mohs Hardness Factor Range: 7.0.
5. GL-5 (Semi-Gloss) 800 grit.
   a. Gloss Reading: 38-42.
   b. Maximum Level of Slip Resistance (COF): 0.656.
   c. Mohs Hardness Factor Range: 7.5.
6. GL-6 (Semi-Gloss) 1800 grit.
   a. Gloss Reading: 46-52.
   b. Maximum Level of Slip Resistance (COF): 0.635.
   c. Mohs Hardness Factor Range: 7.5.

B. Verification of Performance:
   1. Ensure concrete finishing components and materials are from a single manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
   1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which, affect the execution of work under this specification section.
   2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
   3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:
   1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

C. Surface preparation:
   1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
   2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.
   3. Determine the Grind Grade level related to the depth of cut, indicating the amount of aggregate that is to be revealed during the initial grinding of the surface:
      a. GGL-I - Grind Grade Level I (Cream Finish):
         1) Grinding only the Portland Paste at the surface of the substrate without exposing small, medium or large aggregate.
      b. GGL-II - Grind Grade Level II (Salt and Pepper Finish):

1) Exposing the fine aggregate such as sand and small aggregate within the substrate. Generally, this level of grind can be achieved within 1/16 inch of the surface.

c. GGL-III - Grind Grade Level III (Medium Aggregate):
1) Exposing more of the overall girth of the aggregate within the substrate. Generally, this level of grind can be achieved within 1/8 inch of the surface.

d. GGL-IV - Grind Grade Level IV (Large Aggregate):
1) Exposing more of the overall girth of the aggregate within the substrate. Generally, this level of grind can be achieved within 1/4 inch of the surface.

3.3 INSTALLATION

A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Provide planetary heads and orbiting machinery for a consistent and unburnished polishing effect.

B. Layout:
1. Lines shall be straight and true, except otherwise indicated.
2. In accordance with approved joints and floor pattern.

C. Assistance:
1. Application shall be in direct consultation and review of the manufacturer.

D. Floor Surface Polishing and Treatment:
1. Integral Color: See Specification Section – CAST-IN-PLACE CONCRETE.
2. Provide polished concrete floor treatment in entirety of slab indicated by drawings. Provide consistent finish in all contiguous areas.
3. Apply floor finish prior to installation of fixtures and accessories.
4. Dyed and Polished Concrete:
a. Locate demarcation line between dyed surfaces and other finishes.
b. Polish concrete to final finish level.
c. Apply selected diluted dyes to polished concrete surface in accordance with manufacturer's written recommendations.
d. Allow dye to dry.
e. Remove residue with dry buffer, reapply as necessary for desired result.
f. Score pattern lines from 1/16 inch to 1/8 inch deep between color changes.
5. Stained and Polished Concrete:
a. Locate demarcation line between stained surfaces and other finishes.
b. Apply first coat of selected stain to concrete surface.
c. Allow stain to dry.
d. Apply second or third coat of selected stain (enough coats to match selected stain) to concrete surface.
e. Allow stain to dry.
f. Polish concrete to final finish level.
g. Remove residue with dry buffer, reapply as necessary for desired result.
h. Score pattern lines from 1/16 inch to 1/8 inch deep between color changes.
6. Apply Hardener / Sealer / Densifier as follows:
a. First coat at 250 ft^2/gal. (or per manufacturer's written recommendations).
b. Second coat at 350 ft^2/gal. (or per manufacturer's written recommendations).

c. Follow manufacturer's recommendations for drying time between successive coats.

7. Apply Oil Repellent Sealer as follows:
   a. First coat per manufacturer's written recommendations.
   b. Second coat per manufacturer's written recommendations.
   c. Follow manufacturer's recommendations for drying time between successive coats.
8. "Diamond" grit-polish concrete floor surfaces with planetary/rotary power disc machine recommended by floor finish manufacturer. Sequence with coarse to fine diamond grit using dry method.
   a. Comply with manufacturer's recommended diamond polishing grits for each sequence to achieve desired finish level. Level of sheen shall match that of approved mock-up.
   b. Expose aggregate in concrete surface only as determined by approved mock-up.
   c. All concrete surfaces shall be as uniform in appearance as possible.
9. Grind & polish perimeter and edges to match field. Hand tools and multiple passes may be required to achieve uniform finish. Visible change in finish from field finish will not be accepted.
10. Remove defects and re-polish defective areas.
11. Finish edges of floor finish adjoining other materials in a clean and sharp manner.

E. Burnishing
   1. Utilizing a burnishing machine with 1,500 grit diamond impregnated pads, provide two (2) burnishings, requiring re-mobilization at the end of the project.
      a. 1st Burnish — Upon completion of floor surface polishing and treatment.
      b. 2nd Burnish — Just prior to occupancy / stocking / moving-in.

3.4 ADJUSTING

A. Polish to higher gloss those areas not meeting specified gloss levels per mock-up.
B. Fill joints greater than 1/8 inch deep flush to surface with color-matching material.
C. Fill cracks greater than 1/8 inch deep flush to surface with color-matching material.

3.5 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
   1. Leave area free of debris.
   2. Clean any soiled surfaces immediately.
   3. Finish shall be clean and ready for the application of any additional finishes.
   4. In accordance with manufacturer's written instructions and recommendations.

3.6 PROTECTION

A. Protection from traffic:
   1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

END OF SECTION

SECTION 04 22 00 – CONCRETE MASONRY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all Concrete Masonry Unit (CMU) materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

    a. Section includes liquid water-repellent admixture added to the concrete masonry units at the time of manufacture.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 11 01 CONCRETE FORMWORK
4. 03 15 14 DRILLED ANCHORS
5. 03 20 00 REINFORCEMENT
6. 03 30 00 CAST-IN-PLACE CONCRETE
7. 05 12 00 STEEL AND FABRICATIONS
8. 05 30 00 METAL DECK
9. 06 10 00 ROUGH CARPENTRY
10. 06 41 23 MODULAR CASEWORK
11. 07 14 16 FLUID-APPLIED WATERPROOFING
12. 07 21 00 INSULATION
13. 07 40 00 METAL PANELS
14. 07 51 13 BUILT-UP ROOFING
15. 07 60 00 SHEET METAL
16. 07 92 00 SEALANTS
17. 08 11 00 METAL DOORS AND FRAMES
18. 08 14 16 WOOD DOORS
19. 08 33 00 COILING DOORS
20. 08 41 00 STOREFRONTS
21. 09 22 16 METAL FRAMING
22. 09 24 00 CEMENT PLASTER
23. 09 29 00 GYPSUM BOARD
24. 09 30 00 TILE
25. 09 50 00 ACOUSTICAL CEILINGS
26. 09 65 10 RESILIENT BASE AND ACCESSORIES
27. 09 91 00 PAINTING
28. 10 14 00 IDENTIFYING DEVICES
29. 10 28 13 TOILET ACCESSORIES
30. 10 44 00 FIRE PROTECTION SPECIALTIES
31. 31 20 00 EARTHWORK
32. 32 31 13 CHAIN LINK
33. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
34. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 REFERENCES

A. Standards:

1. In accordance with the following standards:
   a. ACI American Concrete Institute
   b. ASTM American Society of Testing Materials
   c. CMACN Concrete Masonry Association of California and Nevada
   d. NCMA National Concrete Masonry Association
      1) TEK Bulletins
   e. TMS The Masonry Society

1.3 DEFINITIONS

A. f'm: Specified compressive strength of masonry at age of 28 days, psi.

B. Grout: The filler within the Cells of the Concrete Masonry Units.

C. Mortar: The joint material between the Concrete Masonry Units, both Top and Bottom and on the Ends.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product Data: For each type of product specified.
      a. Manufacturer's standard color range for selection by the Architect.
      b. All data regarding Concrete Masonry Unit, type, and aggregate to be provided.
      c. All data regarding mortar and grout materials, and mix designs to be provided.
      d. All data regarding accessories to be provided.
   2. Shop Drawings: For the following.
      a. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
      b. Reinforcing Steel: Detail bending and placement of concrete masonry unit reinforcing bars.
   3. Samples. For each type, texture and color selected.
      a. Provide 4" x 4" x 1" nominal size Concrete Masonry samples for texture, color, finish and dimension provided on this project as examples of the major CMU Units for the project.
         1) Provide other chips for all others.
      b. Pigmented Mortar: Make samples using the same sand and mortar ingredients to be used on this project.
         1) Label samples to indicate types and amount of pigments used.
   4. Quality Assurance/Control Submittals:
      a. Test Reports:
         1) Concrete Masonry Units: Lineal Shrinkage and Compressive Strength per ASTM C 140 "Test Methods for Sampling and Testing Concrete Masonry Units and Related Units and ASTM C 426 "Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units."
         2) Mortar and Grout: Grout Compressive Strength and Mortar Properties per ASTM C 270 "Specification for Mortar for Unit Masonry." Test and inspection reports in accordance with TMS 602 Level 3 and CBC Section 2105A.
         3) Masonry Core test shall be in accordance with CBC Section 2105A.4.
      b. Certificates:

1) Concrete Masonry Unit Manufacturers Certification per ASTM C 90 "Specification for Loadbearing Concrete Masonry Units."

2) Concrete Masonry Unit Accessory Material Suppliers Certification.

3) CMU producer shall be certified by the manufacturer of integral CMU water repellent admixture.

4) Installer Certification.

5) Contractors Certification.

5. Project Closeout Submittals:
   a. Warranty.
   b. Project Record Documents: In accordance with Specification Section – PROJECT CLOSEOUT.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Material:
      a. Manufacturers certification that Concrete Masonry Units furnished meet or exceed the requirements of this Specification Section per ASTM C 90 "Specification for Loadbearing Concrete Masonry Units".
   2. Suppliers certification for all grout and mortar materials (including aggregate, cement and admixtures) that items furnished meet or exceed the requirements of this Specification Section and per ASTM C 270 "Specification for Mortar for Unit Masonry" • and ASTM C 476 "Specification for Grout for Masonry."
      a. Water Permeance of Masonry: ASTM E 514, "Standard Test Method for Water Penetration and Leakage through Masonry."
      b. Compressive Strength of Masonry Prisms: ASTM C 1314, "Standard Test Method for Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry."
      c. Drying Shrinkage of CMU: ASTM C 426, "Standard Test Method for Drying Shrinkage of Concrete Masonry Units."
   3. Installer:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
   4. Manufacturer/Supplier:
      a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
      b. Manufacturer belonging to the CMACN.

B. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS.

C. Certificates:
   1. Installer's certification that Concrete Masonry Units installation meets or exceeds the requirements of this Specification Section.
   2. Contractor's certification that Concrete Masonry Unit materials and installation meets or exceeds the requirements of this Specification Section.

D. Mockups:

1. Provide a four (4) foot by six (6) foot mock-up wall showing all Concrete Masonry Unit finishes in conjunction with one another, and the mortar joints and tooling required for this Project. Mock-up, once approved, will be the basis for verifying the aesthetic and structural quality of the work for this Project. Protect during construction.

E. Meetings:
1. Pre-Installation: Schedule prior to the start of work.
a. Coordinate the work with other work being performed.
b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
c. Include discussions on the integral water-repellent CMU admixture and water-repellent mortars.
2. Progress: Scheduled by the Contractor during the performance of the work.
a. Review for proper installation of work progress and properly tooled joints.
b. Identify any installation problems and acceptable corrective measures.
c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
a. Inspect and identify any problems, which may impede issuance of warranties or guaranties.
b. Maintaining installed work until the Notice of Substantial Completion has been executed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
1. Products shall be handled in such a manner as to assure that they are free from spalls, breakage and other damage.

B. Acceptance at Site:
1. Products must be in manufacturer's original wrapped pallets with labels indicating brand name, model, and grade.
2. Damaged products will not be accepted.

C. Storage and Protection:
1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation to prevent wetting prior to use.

1.7 PROJECT CONDITIONS

A. Environmental Requirements:
1. Rain: Work under this section shall not be started or maintained under threat of rain unless the work is protected from the rain.
2. Temperature: Ambient temperature to install products shall be forty (40) degrees Fahrenheit and rising.

B. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

1.8 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written standard warranty:
      a. Warranty Period One (1) Year.

C. Installer's Warranty:
   1. In accordance with the terms of the Specification Section - WARRANTIES
      a. Warranty Period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
   1. Specified Concrete Masonry Unit product manufacturer:
      a. BASALITE DIXON].
   2. Specified Integral Water Repellent Admixture for CMU Production:
      a. "Rheopel" as manufactured by BASF, or
      b. "RainBloc" as manufactured by ACM CHEMISTRIES, or
      c. "Dry-Bloc II" as manufactured by W. R. GRACE and CO.
   3. Specified Pre-Blended Water Repellent Admixture for Mortar:
      a. "Rheopel Plus" as manufactured by BASF, or
      b. "RainBlock" as manufactured by ACM CHEMISTRIES, or
      c. "Dry-Bloc Integral Water Repellent" as manufactured by W. R. GRACE and CO.
   4. Specified Grout Admixture product manufacturer:
      a. "Grout Aid" by SIKA.
   5. Specified Joint Reinforcement, Ties and Anchors product manufacturer:
      a. HOHMANN AND BARNARD, INC.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Block:

1. Hollow Load Bearing Units in accordance with CBC Section 2103A.1, and ASTM C 90 "Standard Specification for Loadbearing Concrete Masonry Units," (85 - 105 pcf of concrete or greater):
   a. Primary Aggregate Lightweight Expanded Shale aggregate.
      1) The aggregate used for all Precision Faced Units not visible on the exterior or the interior, can be Pumice aggregate.
   b. All exposed Concrete Masonry Units shall have integral color from manufacturer per material standard ASTM C 979 "Specification for Pigments for Integrally Colored Concrete."
      1) Including all colors to maximum dye content of 6 percent.
   c. Maximum lineal shrinkage from saturated to over dry condition of not more than 0.065 percent.
   d. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2,000 psi.
   e. Integral CMU Water-Repellent:
      1) Integral liquid admixture mixed with concrete during production of CMUs.
      2) Water Permeance of Masonry: Capable of achieving a Class E Rating when evaluated using ASTM E 514 "Test Method for Water Penetration and
2. Nominal Face Dimensions and Finishes: See drawings for locations of Concrete Masonry Unit types and sizes.
   a. CMU shall be:
      1) Split-Faced on one side and Precision-Faced on opposite side.
3. Exposed faces: Provide color and texture matching Architect's sample.

B. Veneer Block (Face Shell):

1. Nominal Face Dimensions and Finishes: See drawings for locations of Concrete Masonry Unit types and sizes, minimum thickness of 1-5/8".
   a. CMU Veneer Block shall be:
      1) Split-Faced Veneer Unit.
   b. Integral CMU Water-Repellent:
      1) Integral liquid admixture mixed with concrete during production of CMU Veneer Block Units.
      2) Water Permeance of Masonry: Capable of achieving a Class E Rating when evaluated using ASTM E 514 "Test Method for Water Penetration and Leakage Through Masonry."
2. Exposed faces: Provide color and texture matching Architect's sample.

C. Joint Reinforcement, Ties and Anchors:

1. General: Comply with requirements below for basic materials, as well as requirements for each form of joint reinforcement, tie, and anchor for size and other characteristics.
2. Hot-Dip Galvanized Steel Wire: Uncoated wire in accordance with ASTM A 82 "Specification for Steel Wire, Plain, for Concrete Reinforcement," with zinc coating applied after prefabrication into units in accordance with ASTM A 123 "Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products," 1.5 oz. per sq. ft, of wire surface.
3. Joint Reinforcement: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units.

a. Width: Approximately 2 inches less than nominal width of walls and partitions, providing mortar cover of not less than 5/8 inch on joint faces exposed to exterior and 1/2 inch elsewhere.

b. Wire Size, Side Rods: 0 gage, 0.15 inches.

c. Wire Size, Cross Rods: 9 gage, 0.15 inches.

d. Wire Size, Two-Piece Adjustable: 9 gage diameter in exterior walls.

e. Single-Wythe Configuration: Truss design, continuous diagonal cross rods spaced not more than 16 inches on center.

f. Flexible Anchors: Masonry to Structural Framework: Two-piece anchors permitting vertical or horizontal differential movement between wall and framework parallel to, but resisting tension and compression forces perpendicular to, plane of wall.

1) Anchorage to Steel Framework: Manufacturer's standard anchors with crimped 1/4 inch diameter wire anchor section for welding to steel 3/16", triangular-shaped wire tie section sized to extend within 1 inch of exterior face of facing wythe.

g. Unit Type Masonry Inserts in Concrete: Cast iron or malleable iron inserts of type and size indicated.

h. Dovetail Slots: Dovetail slots with filler strips, of slot size as required; 22 gage sheet metal.

i. Anchor Bolts: Steel bolts with hex nuts and flat washers, complying with ASTM A 307 "Specification for Carbon Steel Bolts and Standards, 60,000 PSI Tensile Strength," Grade A, hot dip galvanized complying with ASTM A 153 "Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware• ," Class C; sizes and configurations indicated.

j. Reinforcing Bars: In accordance with Specification Section - REINFORCEMENT, deformed steel, per ASTM A 615 "Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement," Grade 60 for bars No. 3 to No. 18.

4. Miscellaneous Masonry Accessories:

a. Non-Metallic Expansion Joint Strips: Premolded, flexible cellular neoprene rubber filler strips, complying with ASTM D 1056 "Specification for Flexible Cellular Materials – Sponge or Expanded Rubber," Grade RE41E1, capable of compression up to 35 percent; width and thickness as required.

b. Weepholes: Pre-manufactured weeps.

D. Mortar and Grout:

1. In accordance with the following:

a. Cement: In accordance with ASTM C 150 "Standard Specification for Portland Cement," Type II.

b. Hydrated Lime: In accordance with ASTM C 207 "Standard Specification for Hydrated Lime for Masonry Purposes," Type [S][N], unless otherwise noted.

c. Quicklime: In accordance with ASTM C 5 "Standard Specification for Quicklime for Structural Purposes."

d. Lime Putty: Made from hydrated lime or quicklime.

1) If made from quicklime, other than processed pulverized quicklime, slake lime and then screen through a No. 16 mesh sieve. Before using, store and protect slaked and screened lime putty for not less than 10 days.

2) Processed pulverized quicklime shall be slaked for not less than 48 hours, and shall be cool when used.

3) Lime putty prepared from hydrated lime may be used immediately after mixing.

4) Lime putty prepared from quicklime or pulverized quicklime shall have a plasticity figure, after slaking and screening, or not less than 200, and shall weigh not less than 83 lbs. per cubic foot. Lime putty prepared from hydrated lime shall conform to ASTM C 207 "Standard Specification for Hydrated Lime for Masonry Purposes," Type S.

e. Mortar Sand: In accordance with ASTM C 144 "Standard Specification for Aggregate for Masonry Mortar."

f. Modified Mortar Sand:

1) In accordance with ASTM C 144 "Standard Specification for Aggregate for Masonry Mortar" modified to not less than 3 percent shall pass the No. 100 sieve.

g. Grout Aggregate: 3/8 inch maximum size and in accordance with ASTM C 404 "Standard Specification for Aggregates for Masonry Grout."

h. Grout Admixture: SIKA "Grout Aid," Type II.

i. Water: Clean and free of harmful amounts of acid, salts, alkali's, or organic materials.

2.3 MIXES

A. Mortar:

1. In accordance with CBC Section 2103A.2 and ASTM C 270 "Specification for Mortar for Unit Masonry".

2. Pre-Blended Mortar Mix:

a. In accordance with ASTM C 270 "Specification for Mortar for Unit Masonry," Type [**S**].

3. Compressive Strength:

a. See General Structural Drawings from the Structural Engineer.

b. 1,800 psi at 28 days minimum.

B. Grout:

1. In accordance with CBC Section 2103A.3 and ASTM C 476 "Specification for Grout for Masonry."

2. Pre-Blended Bag Grout:

a. In accordance with ASTM C 476 "Specification for Grout for Masonry."

3. Fine Grout Mix unless otherwise noted.

4. Compressive Strength:

a. See General Structural Drawings from the Structural Engineer.

b. 2,000 psi at 28 days minimum.

2.4 SOURCE QUALITY CONTROL

A. Fabrication Tolerances:

1. All materials, equipment and placing operations shall be subject to inspection, tests and approval at all times. Agent shall have access to all places where Concrete Masonry Unit materials are proportioned, mixed, cured and stored.

B. Tests and Inspection:

1. All tests will be performed by the Owner's Testing laboratory Agency in accordance with the Specification Section – TESTING LABORATORY SERVICES. Test and Inspection shall be in accordance with TMS 602 Level 3 and CBC Section 2105A.

2. Concrete Masonry Units shall be tested per ASTM C 140 "Test Methods for Sampling and Testing Concrete Masonry Units and Related Units• " and CBC Section 1705A.4.
   a. Lineal Shrinkage: In accordance with ASTM C 426 – "Standard Test method for Drying Shrinkage of Concrete Block."
   b. Compressive Strength: In accordance with ASTM C 140 – "Sampling and Testing of Concrete Masonry Units."
   c. Test three (3) samples of each type of the Concrete Masonry Unit prior to construction.

3. Mortar Tests: At the beginning of Masonry Work, at least 1 test sample each of mortar and grout shall be taken on 3 successive working days, then once per week with at least one sample taken for each 5,000 square feet of wall area, or fraction thereof.
   a. Test specimens for mortar shall be made in accordance with ASTM C 780 "Test method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry." Test specimens shall be continuously stored in moist air until tested.
   b. Mortar shall show a compressive strength of not less than 1,800 psi at 28 days.

4. Grout Tests: At the beginning of Masonry Work, at least 1 test sample each of grout shall be taken on 3 successive working days, then once per week with at least one sample taken for each 5000 square feet of wall area, or fraction thereof.
   a. Test specimens for grout shall be made in accordance with ASTM C 476 "Specification for Grout for Masonry" • and CBC Section 1705A.4 Test specimens shall be continuously stored in moist air until tested.
   b. Grout shall show a compressive strength of not less than 2,000 psi at 28 days.

C. Verification of Performance:
   1. A special inspector shall be employed during the placement of all units, placement of all reinforcing steel, during all grouting operations and during taking of all test specimens.
   2. Reports:
      a. Special Inspector shall submit to Architect and to DSA two copies of each report showing results of tests and inspections.
      b. Report shall state that tests and inspections were made in accordance with specifications.
      c. Report shall state whether materials were in conformance with specifications.
   3. Cost of testing and inspection will be paid by the Owner, unless otherwise specified. Contractor shall pay all costs of re-inspection and/or re-tests due to non-compliance with specifications as a reimbursement directly to the Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
   1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which, affect the execution of work under this specification section.
   2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.

3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
      a. Installation of bolts, reinforcing, inserts, etc. as required.
      b. Check and be responsible for accuracy of dowel locations in concrete where dowels project into Concrete Masonry Unit work.
   2. Control Joints:
      a. See drawings for type and location of control joints.
   3. Bond Beams:
      a. Bond beams shall be located where shown and detailed on the drawings, and shall be reinforced as indicated and as here after specified.
   4. Built-in Work:
      a. Miscellaneous Embedded Items: All items indicated to be embedded in masonry shall be carefully located and anchored to prevent movement during grouting operations. Avoid cutting and patching.
         1) Install all anchor bolts and anchors furnished under other sections.
   5. Cutting or Patching:
      a. Obtain approval prior to cutting or fitting any area not indicated or where appearance or strength of masonry work may be impaired.

B. Protection:
   1. Protect all adjacent surfaces from drips, spray, air pollution of the surrounding environment, and other damage from work under this specification section.
   2. Protect and cover the top of all Concrete Masonry Unit walls at the end of each day's work to minimize water intrusion, regardless of the time of year.
      a. Continue to temporarily cover the top of the walls until the final parapet cap is installed, and the sealer coats are applied.

C. Surface Preparation:
   1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
   2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.
   3. Top surfaces of foundation or slab to receive Concrete Masonry Units shall be clean, rough, and free of laitance, as specified in Specification Section - CAST-IN-PLACE CONCRETE, PART 3. Roughness amplitude shall be a minimum of one-fourth inch.

3.3 INSTALLATION

A. General:
   1. In accordance with Regulatory Requirements and TMS 602.
   2. Set plumb, level, and square.
   3. Provide temporary bracing during erection of masonry work. Maintain in place until masonry has set to provide permanent bracing.

B. Layout:
   1. Lines shall be straight, true and built accurately to dimension.

2. Masonry lines and levels shall be placed to the following tolerances:
   a. Variation from unit to adjacent unit 1/8 inch maximum.
   b. Variation from plane of wall: 1/4 inch in 10 feet.

C. Reinforcement Bar installation:
1. Installation of Vertical Reinforcement Bars:
   a. Where possible, bars shall be one length and centered in open end of Concrete Masonry Units unless noted otherwise on drawings.
   b. Bar may be doweled at top of footing.
   c. Bars shall be accurately and positively held in place before setting Concrete Masonry Units by wiring to a 2 x 6 properly braced near top of bars and not over 8 feet above foundation or at last Grout pour.
   d. For Low Lift Grout, corner bars and other bars in closed cell units shall be lapped a minimum of 48 bar diameters, unless indicated otherwise.
   e. All vertical reinforcing steel shall be braced throughout its height in a manner that will retain the steel in proper position and provide the proper clearance at spacing not to exceed 192 bar diameters.
2. Installation of Horizontal Reinforcing Bars:
   a. Bars shall be laid in bond beam units directly on top of the cross walls of block webs.
   b. Lap splice bars a minimum of 48 bar diameters, unless indicated otherwise.
   c. Reinforcing steel shall be secured to all foundation dowels and held in place at spacing not to exceed 192 bar diameters.
3. Wire horizontal and vertical bars together.
4. Reinforcing steel shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the plans shall not be used. Heating of bars for bending will not be permitted.
5. Bars shall conform accurately to the sizes, shapes, lines and dimensions shown on drawings and with hooks and beds made as detailed. Bars shall be placed as indicated on the drawings and centered on grout space.
6. At the time grout is placed around it, reinforcing steel shall be clean of mill scale or other coatings that will destroy or reduce bond.

D. Setting of Concrete Masonry Units - In accordance with the following:
1. Bonds: Use Running Bond, or as shown on details.
   a. Place masonry to lines and levels indicated to the following tolerances:
      1) Variation from Unit to Adjacent Unit: 1/8-inch max.
      2) Variation from Plane of Wall: 1/4-inch in 10 feet.
   b. Bond: Unless noted otherwise, lay concrete masonry units in bond pattern indicated with vertical joints located over score of unit in course below (and vice versa).
   c. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.
   d. Preserve the vertical continuity of cells in concrete unit masonry. The minimum clear horizontal dimensions of vertical cores shall be 3" x 3" for 8-inch wide block.
2. Align vertical cells to maintain vertical continuity of cells to be filled. Open end or notched units may be used to facilitate installation around cells that contain vertical reinforcement. Minimum unobstructed vertical flue 3" x 3". Remove overhanging mortar or other obstructions or debris from inside of cells.

3. Provide bond beam units at cells containing horizontal reinforcement.

4. Integral Water-Repellent CMU:

   a. Installer shall use only mortar containing compatible integral liquid water-repellent mortar admixture at the manufacturer's recommended addition rate and mixed according to manufacturer's recommended instructions for construction of water repellent masonry exterior walls.

   b. Cover top of unfinished masonry work to protect it from the weather and to prevent accumulation of water in the cells of the CMU.

   c. Cleaning:

      1) Remove "primary" efflorescent from masonry walls exposed in the finished work in accordance with the manufacturer's recommendations and the NCMA TEK Bulletin #8-3A.

      2) Remove dirt or stains from masonry walls exposed in the finished work in accordance with the manufacturer's recommendations and the NCMA TEK Bulletin #8-2A.

      3) Promptly remove excess wet mortar and grout containing integral water-repellent mortar admixture from the face of the masonry as work progresses. Do not use strong acids, over-aggressive sandblasting or high-pressure cleaning methods.

      4) Comply with applicable environmental laws and restrictions.

5. Joints:
   a. Set Concrete Masonry Units in full shoveled bed of Mortar.

   b. Width of joint: 3/8 inch.
      1) Depth of joint: Equal to Face Shell Wall Thickness.
   c. Head joints shall be solidly filled.

   d. Mortar Joint Finish Method:
      1) All mortar joints shall be compressed and shaped by a specific designated tool throughout the project. Provide identical tools when more than one worker is scheduled to finish joints.

      2) At exposed and concealed surfaces:
         a) Vertical Joints: Compressed, Raked and Tooled joints.

         b) Horizontal Joints: Compressed, Raked and Tooled joints.
      3) Provide compressed Flush Joints when other material is to be applied directly onto and over Concrete Masonry Units being covered (including areas covered by rubber base).

6. Vertical Control Joints:
   a. Space joints at 25'-4" o.c. maximum, unless specifically noted otherwise. Joints shall be spaced symmetrically and uniformly and shall be subject to the Architect's approval.

   b. All joints shall be through wall separations with horizontal reinforcing discontinuous.

   c. All joints shall be sealed with backer rods and urethane sealant on both faces. Refer to Specification Section - SEALANTS for sealant requirements.

7. Prior to grouting, the grout space shall be clean so that all spaces to be filled with grout do not contain mortar projections greater than 1/4 inch, mortar droppings and other foreign material.

8. Do not install cracked, broken, chipped or stained masonry units.

9. Lay only dry concrete masonry units.

10. Lay masonry in full bed of mortar, properly jointed with other work. Deep or excessive furrowing of mortar joints is not permitted.
    a. Block Cap: Lay with full mortar coverage on horizontal and vertical joints.
    b. Install grout cap where and as indicated.

11. Fully bond intersections and external and internal corners.

12. Do not shift or tap masonry units after mortar has taken initial set. Where adjustments must be made, remove mortar and replace.

13. Remove excess mortar.

14. Perform job-site cutting with proper tools to provide straight unchipped edges. Take care to prevent breaking masonry unit corners or edges.

15. Step back unfinished work for joining with new work. Do not use toothing.

16. Provide cleanouts as indicated in "installation of grout."

E. Installation of Grout:
1. General:
    a. All cells shall be grouted solid.
    b. Use low lift or high lift grouting at Contractor's option.
    c. Use grout pump, hopper or bucket to place grout.
    d. Place grout in final position within 1-1/2 hours after introduction of mixing water.
    e. Place grout and rod with a 3/4 inch flexible cable vibrator sufficiently to case it to flow into all voids between the cells and around the reinforcing steel. Slushing with mortar will not be permitted.
    f. Stop grout approximately 1-1/2 inches below top of last course, except at top course bring grout to top of wall.
2. Low Lift Grouting Procedure: In accordance with CBC, and to be used only if approved by the Architect.
    a. Set all vertical bars.
    b. Concrete Masonry Unit walls shall be built up 16 inches high uniformly around one complete building unit. No vertical construction joints will be allowed unless noted and detailed on the drawings.
    c. Lay Concrete Masonry Units no higher than 24" and clean cells of mortar.
    d. Set horizontal bars on bond beam unit crosswalls next to verticals.
    e. If course at top of lift contains horizontal reinforcement, grout all cells to a level 3/4" below the top of the Concrete Masonry Units. This will provide about 1-1/4" grout cover over the horizontal bar. Puddle grout in place using a No. 4 bar or a 1 x 2 stick, and repeat puddling in 30 to 60 minutes.
    f. Consolidate each lift twice. Once while placing grout and once more after initial absorption of water but before set.
    g. Repeat steps "c.", "d.", "e." and "f." above until the wall is completed.
3. High Lift Grouting Procedure (only upon prior approval of the Architect , Structural Engineer and DSA) shall be in accordance with CBC:
    a. Clean-outs must be provided at the bottom of each pour for each cell.

1) Construct clean out courses with inverted open-bottom bond beam units involved to permit cleaning of all cells by flushing. Cleanouts shall not be less than 3x4 inch openings cut from one full shell. Do not plug cleanout holes until masonry work, reinforcement and final cleaning of the grout spaces have been completed and inspected.

b. The Contractor is cautioned that with the high lift method, the walls have very little lateral stability against winds or earthquake before grout has set and it shall be this Contractor's responsibility to adequately brace the walls until the roof sheathing is installed.

c. "Dur-O-Wall" reinforcing shall be provided in mortar joints at all wall corners, ends, jambs of openings and wall intersections.

d. Lay up walls subject to maximum height limitations of CBC.

e. Construction procedure shall be as follows:

1) Set all full length vertical bars on center line of wall, centered in cells, and braced as noted above under typical reinforcing.

2) Lay Concrete Masonry Units full height of walls, or 12 feet maximum including wiring horizontal bars to verticals, for one complete building unit. No vertical construction joints will be allowed unless noted and detailed on the drawings.

3) Construct clean out courses with open-bottom bond beam units inverted to permit cleaning of all cells by flushing. Cleanouts shall not be less than 3 x 4 inch openings cut from one full shell. Do not plug cleanout holes until masonry work, reinforcement and final cleaning of the grout spaces have been completed and inspected.

4) Clean all cells and top of foundation wall of mortar by hosing cells with suitable nozzle jet or sandblasting as soon as mortar has partially set. Final cleaning shall be inspected through clean-outs at each cell in base of wall. Remove all mortar fine protruding more than 1/2 inch into the grout space by dislodging the projections with a rod as the work progress or by washing the grout space at least twice a day during erection using a high pressure stream of water.

5) Set vertical bars in closed cells where required; i.e., at wall corners, sides of openings, etc. Wire to horizontals at top and bottom. Use metal spacers at 48" o.c. maximum to hold bars in line.

6) No grout shall be placed until mortar has set a minimum of 3 days in hot weather or 5 days in cold weather, and the top of foundation wall has been thoroughly cleaned and grout plugs have cured a minimum of 48 hours.

7) Place grout in lifts not to exceed 4 feet in height, with a waiting period between lifts, dependent on weather and absorption rate of the masonry, in order to place the succeeding lift after the preceding lift becomes plastic but prior to initial set. The first lift shall be consolidated using mechanical vibrators. After the required waiting period, place the second lift and consolidate with the vibrator, reconsolidating the lift below to a depth of 12 to 18 inches. Repeat the waiting, placing and consolidating process until the top of the grout pour is reached. Reconsolidate the top lift after the required waiting period. The high-lift grouting of any section of wall between lateral flow barriers shall be completed to the top of a pour in one working day unless a new series of clean out holes is established and the resulting horizontal construction joint cleaned.

8) Repeat items 1 - 7 until all cells are filled. The wall must be grouted to its full height during one working day. No horizontal construction joints will be allowed.

9) Above 12 feet level low lift grouting procedures shall be used.

F. Curing:

1. While Concrete Masonry Units are being laid and after, dampen both faces for a period of 3 days using a spray regulated to keep surface damp. After grouting, dampen for a period of 24 hours.

3.4 APPLICATION

A. Applied Finish:

1. Sealer (Coordinate with Specification Section – PAINTING):
   a. Apply sealer to all exterior and all interior surfaces (including all concealed areas such as the backs of parapet walls and in concealed exterior and interior soffits) to minimize efflorescence, and to prevent water intrusion into the interior of buildings from the exposed exterior surfaces.
   b. Apply sealer as directed by the manufacturer.
      1) Coverage and installation rates shall be as per manufacturer's written recommendations.
      2) Apply sealer in minimum two coats at the rates required.

3.5 REPAIR / RESTORATION

A. General:

1. Materials or Workmanship not conforming to appearance or strength specified will be deemed defective and shall be removed and replaced with no change to the contract in time or cost.

2. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units.

3. Pointing: During the tooling of joints, enlarge any voids or holes and completely fill with mortar.

4. Dry brush masonry surface after mortar has set, at the end of each day's work and after final pointing.

5. Leave work and surrounding surface clean and free of mortar sports and droppings.

6. Cleaning: Upon completion of masonry installation, repair all holes. Defective joints shall be cut out and rejointed. Exposed masonry surfaces shall be cleaned free of mortar, or grout stain and efflorescence.

B. Defective Mortar Or Grout:

1. Should the strength of mortar or grout fall below that specified, remainder of Work shall be adjusted to reach required strength. Work in place representing inferior grout and mortar and indicating a strength less than the minimum specified shall be tested by taking and testing core samples. Number and location of cores shall be determined by Structural Engineer.

2. Should compression tests of cores fail to meet required strength, masonry shall be deemed to be defective and shall be removed and replaced at no cost to Owner.

3. Costs relative to taking and testing of core samples shall be paid by the Owner and will be deducted from Contract Amount. Cost of patching core holes shall be borne by the Contractor.

3.6 FIELD QUALITY CONTROL

A. Site Tests:
1. Tests will be performed by the Owner's Testing Laboratory Agency in accordance with the Specification Section – TESTING LABORATORY SERVICES.
2. Mortar and Grout shall be tested per CBC Section 2105A.
   a. Samples shall be continuously stored in moist air until tested.
   b. Grout Compressive Strength: For each mix provided, in accordance with ASTM C 1019 "Standard Test Method for Sampling and Testing Grout".
   c. Mortar Property Specification: For each mix provided in accordance with ASTM C 780 "Standard Test method for Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry."
3. Masonry Core test shall be in accordance with CBC Section 2105A.4.
4. One set of tests for each 5,000 square feet of wall area or portion thereof.

B. Inspection:
1. Inspections will be performed by the Owner's Project Inspector in accordance with Specification Section – TESTING AND INSPECTION SERVICES.
   a. Special Project Inspector shall be employed during the placement of all units, placement of all reinforcing steel, during all grouting operations and during taking of all test specimens.
      1) Per CBC Section 1705A.4
2. Schedule inspections and notify the Architect, Project Inspector, Testing Agency and any other regulatory agencies of the time at least 48 hours prior to the inspection.
3. No work shall be without the required inspections.

3.7 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
1. At the conclusion of the Concrete Masonry Unit work, the Contractor shall clean down all walls, remove all scaffolding and equipment, clean up all debris, refuse, any surplus materials and remove them from the premises.
2. Concrete Masonry Unit walls shall be brushed daily with a mason's soft hair brush to remove surplus mortar and splattering at scaffolding lines. This must be done immediately after initial, but before final set.
3. Grout or mortar spillage shall be removed by use of clean, plain water before it has a chance to set.
4. In areas not cleaned in accordance with the above, the Architect shall have the right to require sandblasting of the entire wall between concrete columns or piers, between control joints or entire wall unit that includes the affected areas.

B. Removal of Stains and Efflorescence:
1. Removal of Stains: In accordance with NCMA TEK Bulletin #8-2A "Removal of Stains from Concrete Masonry."
2. Removal of Efflorescence: In accordance with NCMA TEK Bulletin #8-3A "Control and Removal of Efflorescence."

3.8 PROTECTION

A. Protection from Weather:
1. Protect newly installed work from temperatures in accordance with CBC 2104A.

a. Cold Weather: When ambient air temperature falls below 40 degrees F.
b. Hot Weather: When ambient air temperature rises above 100 degrees F.

2. During installation, cover the top of unfinished masonry work to protect it from the weather and to prevent accumulation of water in the cores of the masonry units.

END OF SECTION

SECTION 05 12 00 – STEEL AND FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all Steel and Fabrications, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 03 11 01 CONCRETE FORMWORK
   4. 03 15 14 DRILLED ANCHORS
   5. 03 20 00 REINFORCEMENT
   6. 03 30 00 CAST-IN-PLACE CONCRETE
   7. 04 22 00 CONCRETE MASONRY UNITS
   8. 05 30 00 METAL DECK
   9. 06 10 00 ROUGH CARPENTRY
   10. 06 41 23 MODULAR CASEWORK
   11. 07 21 00 INSULATION
   12. 07 40 00 METAL PANELS
   13. 07 60 00 SHEET METAL
   14. 07 72 00 ROOF ACCESSORIES
   15. 07 84 00 FIRESTOPPING
   16. 08 11 00 METAL DOORS AND FRAMES
   17. 08 14 16 WOOD DOORS
   18. 08 33 00 COILING DOORS
   19. 08 41 00 STOREFRONTS
   20. 08 70 00 HARDWARE
   21. 09 22 16 METAL FRAMING
   22. 09 50 00 ACOUSTICAL CEILINGS
   23. 09 67 23 RESINOUS FLOORING
   24. 09 91 00 PAINTING
   25. 10 05 00 MISCELLANEOUS SPECIALTIES
   26. 10 11 00 VISUAL DISPLAY BOARDS
   27. 10 44 00 FIRE PROTECTION SPECIALTIES
   28. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   29. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with Specification Section – REGULATORY REQUIREMENTS and the following standards:
      a. AISC: American Institute of Steel Construction
         1) NOTE: All connections shall be designed by the Structural Engineer and approved by DSA/SS.
         2) NOTE: All connections shall be as shown in the Contract Document drawings.

3) AISC 303: 2016 AISC “Code of Standard Practice for Buildings and Bridges,.
4) AISC 360: "Specification for Structural Steel Buildings" u
5) AISC 341Seismic Provisions for Structural Steel Buildings.
6) AISC 348 Specification for Structural Joints using High-Strength Bolts

b. ANSI: American National Standards Institute:
1) ANSI B18.22.1 "Plain Washers."
2) ANSI B18.22.1 "Beveled Washers."

c. ASTM: American Society for Testing and Materials.
1) ASTM A 123: Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
2) ASTM A 153: Standard Specification for Zinc (Hot-Dip) on Iron and Steel Hardware.
3) ASTM A 385: Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
4) ASTM A 780: Standard Specification for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

d. AWS: American Welding Society "Structural Welding Code."
1) AWS D1.1 "Structural Welding Code."
2) AWS D1.8 "Structural Welding Code - Seismic Supplement."
3) AWS A2.4 "Standard Symbols for Welding, Brazing, and Nondestructive Examination."

e. ICC: International Code Council

f. NAAMM: National Association of Architectural Metal Manufacturers
1) Pipe Rail Manual.
2) AISC 348 Specification for Structural Joints using High-Strength Bolts

g. SSPC: The Society for Protective Coatings.
1) SSPC-SP 1 "Solvent Cleaning."
2) SSPC-SP 2 "Hand Tool Cleaning."
3) SSPC-SP 3 "Power Tool Cleaning."
4) SSPC-SP 6 "Commercial Blast Cleaning."
5) SSPC-SP 7 "Brush-Off Blast Cleaning."

1.3 DEFINITIONS

A. AESS: Architecturally exposed structural steel.

B. Welding Definitions:

1.	CVN	Charpy V-Notch (Testing Procedure).
2.	FCAW	Flux Core Arc Welding.
3.	FCAW-G	Flux Core Arc Welding-Gas Shielded.
4.	FCAW-SS	Flux Core Arc Welding-Self Shielded.
5.	G-MAW	Gas Metal Arc Welding.
6.	SMAW	Shielded Metal Arc Welding.
7.	SAW	Submerged Arc Welding.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

B. Product Data.

a. Submit Load Indicating Device information as indicated in Part 3 of this Specification Section, and include Laboratory Test Reports and other data to show compliance with Specification (include Specified Standards).

b. Include certified copies of mill reports covering chemical and physical properties of each type of steel.

c. Submit primer paint system. Obtain certification from the project's Painting Contractor and Paint Manufacturer that primer paint system is compatible with proposed painting systems for this project.

C. Shop Drawings.
1. The Contract Drawings represent the spatial relationship as conceived by the Architect.
a. The production of the structural steel Shop Drawings may require the employment and utilization of a 3-dimensional structural steel fabrication layout program to achieve the exact relationship of all intersecting members.
b. Building sections and details represent interpretations of these relationships and the dimensions shown shall not be relied upon for accuracy and fit, but the Contractor / Structural Steel Fabricator shall verify them and double-check them for accuracy and fit.
c. Any significant variations shall be submitted to the Architect and Structural Engineer for review and approval, of which the conditions may or may not require [DSA/SS] review and approval.
d. "Fit-Up" means and methods are the sole responsibility of the Contractor.
2. Provide all information necessary for the fabrication of component parts. Indicate size and weight of members, type and location of shop and field connections, size and extent of all welds, and welding sequence when required.
3. Include details of cuts, connections, camber, holes and other pertinent data. Include welds by Standard AWS Symbols, and show size, length and type of each weld.
4. Provide sections, drawings, templates and directions for installation of anchor bolts and other anchors.
5. Dimension requirements of structural steel for manufactured items, such as Mechanical Equipment, Dock Levelers, etc. All of these items shall be coordinated and provided by the General Contractor. The General Contractor shall also coordinate and provide dimensions to locate Structural Steel for Window Washing supports such as davits, tie-backs, etc.

D. Shop Drawings for fabrication of AESS components.
1. Identify AESS category for each steel member and connection, including transitions between AESS categories and between AESS and non-AESS.
2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
3. Include embedment Drawings.
4. Indicate orientation of mill marks and HSS seams.
5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation and location of bolt heads.
7. Indicate exposed surfaces and edges and surface preparation being used.
8. Indicate special tolerances and erection requirements.
9. Indicate weep holes for HSS and vent holes for galvanized HSS.
10. Indicate surface preparation, primer, and coating requirements, including systems specified in other Sections.

E. Samples.
1. Provide material samples cut and machined for testing without charge to the Owner.

F. Quality Assurance/Control Submittals.
1. Test Reports:
a. Submit mill analysis and test reports for each heat, in accordance with ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use," certifying conformity with the Specifications. Steel shall be identifiable in the fabricating shop.

b. Submit test reports for each lot of high strength bolts in accordance with ASTM F 3125 "Standard Specification For High Strength Structural Bolts And Assemblies, Steel And Alloy Steel, Heat Treated, Inch Dimensions 120 Ksi And 150 Ksi Minimum Tensile Strength, And Metric Dimensions 830 MPa And 1040 MPa Minimum Tensile Strength" for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength."
c. Submit Welding Procedure Specification (WPS) to the Structural Engineer and special inspector for review prior to use.
1) For WPS's that have been qualified by test, the supporting Procedure Qualification Record (PQR) shall be submitted.
d. Step by step welding sequence for the field welding of each type of connection.
e. Quality control plan that addresses all inspection issues, including in process and final inspection that are addressed in AWS D1.1.

2. Certificates:
a. Submit current valid certificate issued by an independent testing agency for all welders, welding operators, and tack welders.
b. Certification of Welder's Qualifications: Welders that will make welds in restricted access, such as, but not limited to, the bottom flange-to-column welds through a cope hole or access hole in the beam web, shall be qualified by the Contractor using the same welding procedure as will be used for production and a mock-up assembly that simulates the construction configuration.
c. Provide Certified Mill Test Report Sheets in accordance with ASTM A123 "Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products," certified at the plant after galvanizing, but prior to shipment.

G. Closeout Submittals:
1. Project Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.
2. Warranty.

1.5 QUALITY ASSURANCE

A. Qualifications:
1. Installer Qualifications:
a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
b. Welders shall be recently qualified by Test as prescribed in AWS "Structural Welding Code" for the type of welding to be performed.
1) All welders, welding operators, and tack welders shall be qualified with the largest diameter electrode(s) to be used on the work by test and hold a current valid certificate issued by an independent testing agency, to perform the type of welds required by the work; including the process, position, and thickness of materials used (AWS D1.1: Clauses 3 & 4 Sections).
2) In addition to meeting the requirements of AWS, welders that will make welds with restricted access, such as, but not limited to, the flange to column welds through a cope hole or access hole in the beam web, or where access to the bottom of a groove is restricted by the presence of a column flange, shall be qualified by the Contractor using the same welding procedure as will be used for production and a mock-up assembly that simulates the construction configuration.
3) All welders on the project shall be capable of understanding and following the requirements of the written WPS.
4) Each welder employed on the project shall understand all the requirements of this welding specification before welding on the project.
5) The written WPS shall be available to the welder, welding supervisor, and all inspectors.

6) Provide weld procedures for both pre-qualified welds and special welds to be submitted to the Owner's Testing laboratory and the Architect. Procedures shall be provided for both shop & field welds and shall be provided prior to commencing welding operations.

2. Manufacturer/Supplier Qualifications:
   a. Structural Steel firm experienced in successfully producing/supply capacity to produce/supply required units without causing delay in the Work.
   b. Provide documentation that the Hot-Dipped Galvanizer is a member in good association with the AGA (American Galvanizers Association).

B. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS.

C. Mockups:
   1. A typical mockup of welded connections shall be provided prior to shop fabrication.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Product Handling:
   1. Store materials to permit easy access for inspection and identification. Keep steel members off the ground using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1.7 SCHEDULING

A. Schedule the Work so that there will be no excessive inspection time. At all times that an inspector is required, sufficient work shall be laid out and adequate personnel supplied so that the Inspector's time will be used to full advantage. If inspection costs become excessive because of poor shop procedure, such excess costs will be paid for by the Owner, but deducted from the Contract Price. Poor procedures will be determined upon review of Inspection and/or Testing Reports. The rate for charging the excess costs will be as follows:
   1. Minimum of three (3) certified welders are used, Owner will pay 100 percent.
   2. Only two (2) certified welders are used, Contractor will be charged 1/3 of the Inspection cost.
   3. Only one (1) certified welder is used, the Contractor will be charged 2/3 of the inspection cost.

1.8 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written standard warranty:
      a. Warranty Period One (1) Year.

C. Installer's Warranty:
   1. In accordance with the terms of the Specification Section - WARRANTIES
      a. Warranty Period One (1) Year.

PART 2 - PRODUCTS

2.1 GENERAL

A. The products listed establish size, pattern, color range and function selected by the Architect for this Project. Acceptable alternatives and substitutions must comply with the requirements of this project. If the acceptable alternatives or substitutions are not approved due to non-compliance with the contract documents, then the Contractor shall submit the specified product.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Steel:
   1. Angles, Channels, Plates, and Bars: Shall be made in accordance with ASTM A 36, "Specifications for Carbon Structural Steel." Shall be made in accordance with unless otherwise indicated on drawings.
      a. ASTM A 572, "Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel," Grade 50.
      b. ASTM A 992, "Standard Specification for Steel for Structural Shapes for use in Building Framing" Grade 50.
   2. Pipe: Shall be in accordance with "Specifications for Welded and Seamless Steel Pipe," ASTM A 53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless," Grade C, or otherwise noted.
      a. Finish: Type E, for concealed conditions, Black, except where indicated on the drawings to be galvanized.
      b. Finish: Type S, for visually exposed conditions, Black, except where indicated on the drawings to be galvanized.
   3. Structural Tubes:
      a. Cold-Formed tubing: Shall be in accordance with ASTM A 500 "Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes," Grade C.
      b. Hot-Formed tubing: Shall be in accordance with ASTM A 501 "Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing."
      c. All HSS sections (round and square) shall have their material certifications reviewed by the special inspector.
         1) The special inspector shall verify that all seam welds are fused in accordance with ASTM A 500 "Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes," Grade B.
         2) The special inspector shall, as a minimum, visually inspect the exterior of all seam welds.

B. Light Gauge Cold Formed Shapes: In accordance with the following, unless otherwise noted on the Structural Engineer's Drawings:
   1. ASTM A 653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process," such as "Zee" purlins, angles bent plated, etc.
   2. ASTM A 1011 "Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability."

C. Plastic Steel Putty:
   1. Specified Plastic Steel Putty product manufacturer, or approved equivalent:
      a. DEVCON Plastic Steel Putty A.

2.3 COMPONENTS

A. Fasteners shall be in accordance with the following, unless otherwise noted on the Structural Engineer's Drawings:

B. Anchor Bolts:
   1. All anchor bolts cast in concrete or masonry shall be headed bolts with cut threads conforming to:

a. ASTM F 1554 "Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength."

C. Machine Bolts:
1. ASTM A 307 "Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength."

D. Direct Tension Indicators:
1. Provide in accordance with ASTM F 959 "Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners," type as required.
a. Use on all bolts for ASTM F 3125 "Standard Specification For High Strength Structural Bolts And Assemblies, Steel And Alloy Steel, Heat Treated, Inch Dimensions 120 Ksi And 150 Ksi Minimum Tensile Strength, And Metric Dimensions 830 MPa And 1040 MPa Minimum Tensile Strength."

E. High Strength Bolts, Nuts and Washers: Install in accordance with requirements for ASTM F 3125 "Standard Specification For High Strength Structural Bolts And Assemblies, Steel And Alloy Steel, Heat Treated, Inch Dimensions 120 Ksi And 150 Ksi Minimum Tensile Strength, And Metric Dimensions 830 MPa And 1040 MPa Minimum Tensile Strength"slip critical and snug tight conditions as indicated on drawings. Install high strength bolts with snug tight type connections with threads included in shear plane except as otherwise noted. Install hardened washers in conformance with AISC Specifications.
1. Bolt Geometry: Bolt dimensions shall conform to the current requirements of the American National Standards Institute for Heavy Hex Structural Bolts, ANSI Standard B18.2.1. The length of bolts shall be such that the end of the bolt will be flush with or outside the face of the nut when properly installed.
2. Provide hexagonal heads and nuts for all connections per ASTM A 563 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process," Appendix Table X1.1.
3. Nut Specifications: Nuts shall conform to the current chemical and mechanical requirements of the American Society for Testing and Materials Standard Specification for Carbon and Alloy Steel Nuts, ASTM A 563 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process," Appendix Table X1.1 Provide grade A Heavy Hex nuts for ASTM A 36 threaded rods. Use grade C, Heavy Hex nuts for ASTM A 572 "Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel" Grade 50 and ASTM A 588 "Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi (345 Mpa) Minimum Yield Point to 4-inc (100-mm) Thick" threaded rod.
4. Washers: Flat circular washers and square or rectangular beveled washers shall conform to the current requirements of the American Society for Testing and Materials Standard Specification for Hardened Steel Washers, ASTM F 436 "Standard Specification for Hardened Steel Washers."
5. Tension Control Fastener System:
a. LOHR, LEJEUNE, NUCOR FASTENER, CORDOVA BOLT, INC., or approved equivalent.

F. Headed Stud-Type Shear Connectors: ASTM A 108 "Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality" Grade 1015 or 1020 Cold-finished carbon steel with dimensions complying with AISC Specifications.

G. Power Driven Fasteners: Tempered steel pins with special corrosive resistant plating or coating. Pins shall have guide washers to accurately control penetration. Fastening shall be accomplished by low-velocity piston-driven power activated tool. Pins and tool shall be as manufactured by Hilti Fastening Systems.

H. Filler Metal and Welding Flux in accordance with AWS D1.1 Clause 5 "Fabrication Section", and AISC 360, Section A3.5, and shall meet a CVN Impact Energy of 20 ft-lbs at minus 20 Degrees F.
1. FCAW A5.20 or A5.29 E7XT-X.
2. G-MAW A5.18 or A5.28 E70S-X.

3. SAW A5.17 or A5.23 E7X-EXXX.
4. SMAW A5.1 or A5.5 E70XX Low Carbon.

I. Turnbuckles:
1. ASTM F 1145, "Standard Specification for Turnbuckles, Swaged, Welded, Forged."
2. The supplier shall provide turnbuckles manufactured from the same production lot.
3. The manufacturer shall provide test reports indicating the safe load of the turnbuckles using a safety factor of 5.
4. Turnbuckles shall be in compliance with ASTM F 606 "Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets."

2.4 FABRICATION

A. Shop Assembly:
1. Fabricate in accordance with AISC Spec and AISC Code unless otherwise indicated on Drawings or Specifications.
a. Mechanically curve specific Structural members as indicated on the drawings in accordance with AISC requirements and tolerances.
2. Fabricate all structural steel members and fittings.
3. Fabricate all miscellaneous metal fabrications scheduled in Part 3 of this Specification Section.
4. Architecturally Exposed Structural Steel and "Exposed to View" Metal Fabrications:
a. Comply with AISC 303, Section 10 - "Architecturally Exposed Structural Steel"
b. At all exposed joints, continuous fill with Plastic Steel Putty. Sand smooth and uniform and ready to receive finishes.
1) Clean all areas to have smooth seams with manufacturers recommended cleaner.
2) Place Steel Putty and cure.
c. Also, refer to drawings.

B. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with the AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated. The contractor shall coordinate member tolerances with finishes.
1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
3. Columns:
a. All columns and beams shall adhere to Section M2.7 of the referenced "Specification for Structural Steel for Buildings" which states that completed members shall be free of twists, bends, and open joints.

C. Connections: Weld or bolt shop connections, as indicated. Bolt field connections, except where welded connections or other connections are indicated.

D. Unless noted otherwise, make holes 1/16 inches larger than the nominal bolt diameter.
1. For anchor bolts, the hole diameter may not exceed the sizes indicated in CBC Section 2204A.4, nor what is specified on the drawings.

E. Welding, Shop and Field: Weld by shielded arc method, submerged arc method, flux cored arc method, or other method approved by AWS. Perform welding in accordance with AWS Code. All welders, both manual and automatic, shall be certified in accordance with AWS "Standard Qualification Procedure" for the Work to be performed. See paragraph "welding" herein, for detailed requirements. If sizes of fillet welds are not shown on drawings, use AWS minimum weld size but not less than 3/16 inch fillet welds.

F. Bolt Holes for Other Work: Provide holes required for securing other work to structural steel framing.

1. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.
2. Cut, drill or punch holes perpendicular to metal surfaces and remove all burrs. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

G. AISC Heavy Section shapes and built up members shall meet the requirements for joints in AISC Sections J1.5, J1.6, J2.7 and M2.2.

H. High Strength Bolts:
1. Installation and Tightening:
a. Handling and Storage of Fasteners: Fasteners shall be protected from dirt and moisture at the job site.
1) Only as many fasteners as are anticipated to be installed and tightened during a work shift shall be taken from protective storage.
2) Fasteners not used shall be returned to protected storage at the end of the shift.
3) Fasteners shall not be cleaned of lubricant that is present in as-delivered condition.
b. Tension Calibrator: A tension measuring device shall be required at all job sites where bolts in slip-critical joints are being installed and tightened.
1) The tension measuring device shall be used to confirm:
a) The suitability to satisfy the requirements of AISC for the complete fastener assembly, including lubrication if required to be used in the work,
b) Calibration of wrenches, if applicable, and
c) The understanding and proper use by the bolting crew of the method to be used.
2) The frequency of confirmation testing, the number of tests to be performed and the test procedure shall be as specified in 1.d. below, as applicable.
a) The accuracy of the tension-measuring device shall be confirmed through calibration by an approved testing agency at least annually.
c. Joint Assembly and Tightening of Shear/Bearing Connections: Bolts in connections not within the slip-critical category shall be installed in properly aligned holes, but need only be tightened to the snug tight condition.
1) The snug tight condition is defined as the tightness that exists when all plies in a joint are in firm contact.
2) This may be attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench.
3) If a slotted hole occurs in an outer ply, a flat hardened washer or common plate washer shall be installed over the slot.
d. Joint Assembly and Tightening of Connections Requiring Full Pre-tensioning. Slip-critical connections shall be installed in properly aligned holes and tightened by one of the following methods.
1) Turn-of-nut Tightening: When turn-of-nut tightening is used, hardened washers are not required except as specified in the AISC.
a) A representative sample of not less than three bolts and nuts of each diameter, length and grade to be used in the work shall be checked at the start of work in a device capable of indicating bolt tension.
b) The test shall demonstrate that the method of estimating the snug-tight condition and controlling turns from snug tight to be used by the bolting crews develops a tension not less than five percent greater than the tension required for slip-critical connections.
2) Installation of Alternate Design Bolts: A representative sample of not less than three bolts of each diameter, length and grade shall be checked at the job site in a device capable of indicating bolt tension.

a) The test assembly shall include flat-hardened washers, if required in the actual connection, arranged as in the actual connections to be tensioned.
b) The calibration test shall demonstrate that each bolt develops a tension not less than five percent greater than the tension required by AISC.
c) Manufacturer's installation procedure shall be followed for installation of bolts in the calibration device and in all connections.
d) When alternate design features of the fasteners involve an irreversible mechanism such as yield or twist-off of an element, bolts shall be installed in all holes of the connection and initially brought to a snug tight condition.
e) All fasteners shall then be tightened, progressing systematically from the most rigid part of the connection to the free edges in a manner that will minimize relaxation of previously tightened fasteners prior to final twist-off or yielding of the control or indicator element of the individual fasteners.
f) In some cases, proper tensioning of the bolts may require more than a single cycle of systematic tightening.

e. Mark bolts that have been completely tightened with an identifying symbol.
1) Final tightening of high strength bolts in webs of beam to column moment connections shall be performed after completion of flange welding.

I. Welding - General:
1. General: Quality of materials and design and fabrication of all welded connections shall conform to AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Building," AWS "Code for Welding in Building Construction," AWS "Structural Welding Code - Seismic Supplement," and requirements of this section.
a. Location and type of all welds shall be as shown. Make no other welded splices, except those shown on drawings, without prior approval of the architect.
2. Automatic Welding: Use electrode wire and flux for automatic and semi-automatic welding acceptable to Architect. All methods, sequences, qualification and procedures, including preheating, and post heating if necessary, shall be detailed in writing and submitted to the architect for review.
3. Qualification of Welders:
a. Structural steel welding: Manual and automatic welds for structural steel construction shall be made only by operators who have been previously qualified by tests, as prescribed in AWS D1.1 and D1.8 to perform type of work required.
b. Welders shall be checked by the welding inspector. Those not doing satisfactory work may be removed, and may be required to pass qualification tests again. All qualification testing shall be at the Contractor's expense.
c. Only welders whose weld procedures and pre-qualification by testing that have passed shall be considered qualified for such welds.
4. Control cooling process after weld is completed by either step down post heat or thermal blankets as determined by procedures and prequalification.
5. Box columns and built-up members shall have ultrasonic testing before and after welding.
6. Flame cut surfaces shall be ground to remove contaminated steel layer to provide welds proper fusion without impurities.
7. Preparation of surface: Surfaces to be welded shall be free of loose scale, slag, rust, grease, paint and any other foreign material.
8. Welding equipment: Welding equipment to be used in each case shall be acceptable to welding inspector. Use equipment with suitable devices to regulate speed and manually adjust operating amperage and voltage. The amperage capacity shall be sufficient to overcome line drop, and to give adequate welding heat.

9. Remove runoff tabs and grind surfaces smooth where the tabs would interfere with fireproofing and architectural finishes.
10. End-welded studs:
    a. Automatic end-welded studs: Automatically end-weld in accordance with the manufacturer's written recommendations in such a manner as to provide complete fusion between the end of the stud and the plates. There shall be no porosity or evidence of lack of fusion between the welded end of the stud and the plate. The stud shall decrease in length during welding approximately 1/8 inch for 5/8 inch, and 3/16 inch for 3/4 inch diameter. Stud sizes indicated on drawings represent the finish stud height.
    b. Fillet-end welded studs: Studs may be welded using prequalified FCAW, GMAW, or SMAW processes provided the requirements of the AWS D1.1 Clause 7 "Stud Welding" are met as well as any other pertinent requirements of D1.1.
11. Provide mill camber as shown on the construction documents within AISC tolerance. Place mill tolerance upward for all beams specified no camber.

2.5 FABRICATION, AESS

A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.
   1. Use special care handling and fabricating AESS before and after shop painting to minimize damage to shop finish.

B. Architecturally Exposed Structural Steel, Category AESS 4:
   1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
   2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
   3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
   4. Make intermittent welds appear continuous, using filler or additional welding.
   5. Seal weld open ends of hollow structural sections with 3/8-inch (9.5-mm) closure plates.
   6. Limit butt and plug weld projections to 1/16 inch (1.6 mm).
   7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
   8. Remove weld spatter, slivers, and similar surface discontinuities.
   9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
   10. Grind tack welds smooth unless incorporated into final welds.
   11. Remove backing and runoff tabs, and grind welds smooth.
   12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
   13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
   14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
   15. Conceal fabrication and erection markings from view in the completed structure.
   16. Make welds uniform and smooth.
   17. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
   18. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
   19. Orient HSS seams as indicated or away from view.
   20. Align and match abutting member cross sections.

21. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of 1/8 inch (3.2 mm). At closed joints, maintain uniform contact within 1/16 inch (1.6 mm).
22. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.
23. Treat HSS seams to appear seamless.
24. Contour and blend welds and weld transitions between members, removing splatter exposed to view.
25. Fill surface imperfections with filler and sand smooth to achieve surface quality approved by Architect.
26. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.

2.6 FINISHES

A. Shop Cleaning:
   1. Clean all surfaces of steel. Remove all rust, mill scale, deposits of splatter, slag or flux, oil, dirt, and all other materials.
      a. Use hand tool, power tool, sandblasting, chemical cleaning, and any other method necessary to provide a smooth, sound surface.
   2. Clean contact surfaces of high strength bolt of all burrs and material, which might prevent solid seating of the parts. Steel to receive bolts shall be primer painted except beneath the contact area of slip-critical bolts.

B. Shop Priming:
   1. General:
      a. "Painting of structural steel shall comply with the requirements contained in AISC 360. Painting of open-web steel joist girders shall comply with the requirements of SJI CJ-1.0, SJI JG-1.1, SJI K-1.1 and SJI LH/DLH-1.1. Individual structural members and assembled panels of cold-formed steel construction shall be protected against corrosion in accordance with the requirements contained in AISI S100. Protection of cold-formed steel light-frame construction shall also comply with the requirements contained in AISI S200," per CBC Section 2203A.1.
      b. Shop prime all steel except the following:
         1) Surfaces embedded in concrete, or mortar. Extend priming of partially embedded members to a depth of 2 inches.
         2) Contact surfaces for slip-critical (sc) high strength bolts.
         3) Surfaces within 2 inches of field welds.
         4) Top of structural support members when metal deck is welded to supports.
            a) Primer is required when metal deck is mechanically attached to structural support members.
         5) Surfaces to receive sprayed-fire-resistive materials (applied fireproofing).
         6) Surfaces to be galvanized.
   2. Priming:
      a. Immediately after surface preparation, apply primer according to manufacturer’s written instructions and at a rate recommended by SSPC to provide minimum film thickness. Use priming methods that results in full coverage of joints, corners, edges and exposed surfaces.
         1) Strip paint corners, crevices, bolts, welds and sharp edges.
         2) Apply two shop prime coats to areas, which will be inaccessible after assembly or erection.
      b. Provide PPG PAINTS field primers; or approved equivalent. Should the Contractor substitute another paint company other than "PPG PAINTS" in Specification Section - PAINTING, then coordination of steel primers with finish coats specified in Specification Section - PAINTING is the Contractor's responsibility.

c. Use the following shop painting systems on all normal environment interior steelwork:
   1) Surface Preparation: SSPC-SP2 "Hand Tool Cleaning" or SSPC-SP3 "Power Tool Cleaning."
   2) Application: Follow coating manufacturer's printed directions.
   3) Material: PPG PAINTS MULTI-PRIME 94-258 Primer.
   4) Number of Coats: One.
   5) Dry Film Thickness: 2.0 mils minimum.
   6) Volume Solids: 51.0 +/- 1.0% minimum.
   7) Generic Description: Modified Alkyd Resin Universal Primer.

d. Use the following shop painting systems on all exterior steelwork and interior steelwork subjected to wet conditions or fumes.
   1) Surface Preparation: SSPC-SP6 "Commercial Blast Cleaning."
   2) Application: Follow coating manufacturer's printed directions.
   3) Material: PPG PAINTS AMERCOAT 68HS Primer.
   4) Number of Coats: One.
   5) Dry Film Thickness: 5.0 mils minimum.
   6) Volume Solids: 78% +/-2%
   7) Generic Description: Reinforced Inorganic Zinc-Rich Urethane.

C. Hot-Dip Galvanizing:
1. Zinc coatings on iron and steel products in accordance with ASTM A 123 "Standard Specification for Zinc (Hot-Dip Galvanzied) Coatings on Iron and Steel Products."
   a. Minimum thickness required shall be 3.9 mils.
2. Galvanize all items outside of the building envelope including, but not limited to structural steel columns and beams, railing systems, awnings, canopies, shade structures, etc., per ASTM A 385, "Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)."
3. Zinc coatings on iron and steel hardware shall be in accordance with ASTM A 153 "Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware."
4. Galvanized repair paint: High-Zinc-Dust-Content, in accordance with SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight paint for re-galvanizing welds and repair painting galvanized steel.
5. All weep holes proposed to be provided for hot-dip galvanizing shall be included in the shop drawings, subject to review and acceptance by the Structural Engineer.
   a. Weep holes in exposed steel shall be plugged flush painted with repair paint.

D. Stainless Steel Finishes:
1. Remove tool and die marks and stretch lines or blend into finish.
2. Grind and polish to produce uniform, directionally textured, polished surfaces without cross-scratches. Run grain with long dimension of each piece.
3. Bright Directional Satin Finish No.4, unless otherwise shown on drawings.
4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.7 SOURCE QUALITY CONTROL

A. Tests, Inspection:
1. In accordance with Specification Section – TESTING LABORATORY SERVICES and the following:
   a. Materials shall be certified, identified and tested in conformance with CBC Table 1705A.2.1. Commercial stock steel shall be identified in accordance with CBC Table 1705A.2.1.
   b. Complete four-sided inspection of all steel shall be made when required by Architect.

c. Tests and inspection of Shop and field welding in accordance with CBC Table1705A.2.1. Perform shop and field welding only under supervision of welding inspector.
   1) Welds shall be in accordance with CBC Table 1705A.2.1.
   2) Inspection:
      a) Welding inspector shall be an AWS Certified Welding Inspector (CWI).

d. Tests & Inspection for High Strength Bolts in accordance with CBC Table 1705A.2.1.

2. Testing Laboratory:
   a. An inspection and testing laboratory will be selected by the Owner for testing and inspection as required by the Contract Documents. The selected laboratory shall conform to the requirements of ASTM E 329 "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction." Documentary evidence of such conformance shall be submitted to the Owner and the Governing Agency.
   b. All materials, work, methods and equipment shall be subject to inspection at the mill, fabricating plant and at the building site. Material or workmanship not complying fully with the Contract Documents will not be accepted. The Contractor shall give the Testing Laboratory reasonable notice when ready for inspection and shall supply samples and test pieces and all facilities for inspection without extra charge. The Owner will assume the expense of making the tests and inspection except as otherwise specified in Division 1.
3. Cost of Testing and Inspection: Costs of testing and inspection of structural steel, except as specified hereunder and in Division 1, will be paid for by the Owner.
   a. All transportation costs and per diem living costs for inspection at fabricator's plant further than 75 miles from the job site will be back-charged to the Contractor.
   b. It is assumed that all fabrication will take place in one shop location only. All additional inspection costs will be back-charged to the Contractor.
   c. All mill tests and costs or re-test of plain materials shall be at the expense of the Contractor.
   d. Costs of tests required due to Contractor's failure to provide steel identifiable in accordance with the indicated ASTM designation shall be at the expense of the Contractor.
4. Structural Steel Testing and Inspection:
   a. If structural steel tests are indicated as required on the structural drawings, one tension and one bend test shall be made for each size of structural shape, plate and for each tube and pipe size. Tests to be made in accordance with requirements of appropriate ASTM designations.
   b. If structural steel tests are not indicated as required on the structural drawings, then for shapes, plates, bars, pipe and tubing, manufacturer's certified mill test reports and analysis for each heat will be acceptable for steel identifiable in accordance with indicated ASTM designation. Mill test reports shall indicate the physical and chemical properties of all structural steel used. Correlate individual heat numbers with each specified structural section.
   c. Unidentifiable Steel:
      1) For Fy less than or equal to 36.0 ksi: Provide one tension and elongation test and one bend for each 5 tons or fraction thereof for each size.
      2) For Fy greater than 36.0 ksi: Provide one tension and elongation test and one bend or flattening for each piece.
   d. Costs of re-tests and additional testing required by the use of unidentifiable steels shall be the Contractor's responsibility. Additional costs of testing incurred by the Owner shall be deducted from the Contract Final Payment.
5. Expansion Anchors: Load test as indicated on the drawings.
6. Welding Inspection:

a. If shop or field welding inspection is indicated on the structural drawings, all shop and field welded operations shall be inspected by a qualified welding inspector employed by the Testing Laboratory. Such Inspector shall be a person trained and thoroughly experienced in inspection of welds. The inspector's ability to distinguish between sound and unsound welding will be reliably established.

b. The Welding Inspector shall make a systematic record of all welds. This record shall include:
   1) Identification marks of welders.
   2) List of defective welds.
   3) Manner of correction of defects.

c. The welding inspector shall check the material, equipment and procedure, as well as the welds. He/she shall also check the ability of the welder. He/she shall furnish the Architect with a report, duly verified by him/her that the welding which is required to be inspected is proper, and has been done in conformity with the Contract Documents, and that he/she has used all means to determine the quality of the welds.

d. All full penetration groove welds shall be subject to ultrasonic testing, as per AWS D1.1, Clause 6 "Inspection, Part "C", Ultrasonic Testing of Groove Welds." All defective welds shall be repaired and re-tested with ultrasonic equipment at the Contractor's expense.

e. Column Flanges: An area extending 6 inches above and below point where girder flanges area attached shall be inspected. Column flange edges shall be inspected visually, and entire area ultrasonically for lamination, plate discontinuities, and non-metallic inclusions.

f. All partial penetration groove welds shall be tested by ultrasonic testing.

g. When ultrasonic indications arising from the weld root be interpreted as a defect, the Engineer shall be notified. The Engineer may require the removal of backing strip. The backing strip shall be removed at the expense of the Contractor, and if no root defects are visible the weld shall be re-tested. If no defect is indicated on this re-test, and no significant amount of base and weld metal have been removed, no further repair of welding is necessary. If a defect is indicated, it shall be repaired and re-tested at the Contractor's expense.

h. The ultrasonic instrumentation will be calibrated by the technician to evaluate the quality of the welds in accordance with AWS D1.1.

i. Other methods of inspection, for example, X-ray, gamma ray, magnetic particle, or dye penetrant, may be used on welds if felt necessary by the inspection laboratory, and with the approval of the Engineer.

j. Base metal thicker than 1-1/2 inches, when subjected to through thickness weld shrinkage strains, shall be ultrasonically inspected for discontinuities directly behind such weld before and after joint completion.

k. End-welded studs shall be sampled, tested, and inspected per the requirements of the Structural Welding Code – Steel D1.1, published by the American Welding Society.

l. At the discretion of the Owner's testing agency, the ultrasonic testing frequency may be reduced but may not be less than the following:
   1) Initially, all welds requiring ultrasonic testing will be tested at the rate of 100 percent in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than 5 percent of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 25 percent. If the reject rate increases to 5 percent or more, 100 percent testing will be re-established until the rate is reduced to less than 5 percent. The percentage of rejects will be calculated for each welder independently.

m. A sampling of at least 40 completed welds will be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejected

defects divided by the number of welds completed. For evaluating the reject rate of continuous welds over 3' in length, each 12 linear inch increment of welds, 1 inch or less in thickness, will be considered as one weld. For evaluating the reject rate of continuous welds greater than 1 inch thickness, each 6 linear inches will be considered one weld.

7. High Strength Bolting Tests and Inspection:
   a. Furnish certified test reports for each lot of bolts which are tested in accordance with ASTM F 3125 "Standard Specification For High Strength Structural Bolts And Assemblies, Steel And Alloy Steel, Heat Treated, Inch Dimensions 120 Ksi And 150 Ksi Minimum Tensile Strength, And Metric Dimensions 830 MPa And 1040 MPa Minimum Tensile Strength." Install bolts under the supervision of a qualified bolting inspector in accordance with, Research Council "Specifications for Structural Joints Using High-Strength Bolts" and AISC 341-16 §J7.
   b. While the work is in progress, the Inspector shall determine that the requirements of this Specification are met in the work. The Inspector shall observe the calibration procedures and shall monitor the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is properly used to tighten all bolts.
      1) In addition to the requirement of the foregoing paragraph, for all connections specified to be slip critical (SC), the Inspector shall assure that the specified procedure was followed to achieve the pretension specified in the AISC. The pre-tension shall be verified by the Inspector for these bolts.
      2) Bolts in connections identified as not being slip-critical nor subject to direct tension need not be inspected for bolt tension other than to ensure that the piles of the connected elements have been brought into snug contact.

B. Verification of Performance:
   1. Testing Agent shall be a qualified person or Testing Laboratory listed and approved by DSA/SSS and selected by the Architect, and the Owner.
   2. Testing Agent shall make Test and Inspection Reports certifying materials and workmanship to conform with Drawings and Specifications.
      a. Cost of Testing and Inspection will be paid by Owner unless otherwise specified.
      b. Cost of cutting and machining test samples shall be paid by Contractor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel erector present, elevations of concretebearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
   1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Employ a licensed land surveyor for accurate erection of structural steel.
   1. Check elevations of bearing surfaces (concrete), and locations of anchor bolts and similar devices, before erection work proceeds.
   2. Report discrepancies to Architect.
   3. Do not proceed with erection until corrections have been made or until compensating adjustments to structural steel work have been agreed upon with the Architect.

B. Erect all Structural Steel frame work in accordance with AISC Specifications "Specification for the Design, Fabrication and Erection of Structural Steel for Building," latest edition, and AISC Code unless otherwise indicated on Drawings or Specification.
   1. Framing: Carry up framing true and plumb. Provide temporary bracing wherever necessary to support all loads to which the structure may be subjected, including erection equipment and its operation. Leave bracing in place as long as may be required for safety. As erection progresses securely connect the work to take care of all dead load, wind and erection stresses.
   2. Connections:
      a. Machine Bolts shall be installed with cut washer under nut.
      b. High Strength Bolts shall be used to assemble structural joints in accordance with AISC "Specification for Structural Joints using bolts for ASTM F 3125 "Standard Specification For High Strength Structural Bolts And Assemblies, Steel And Alloy Steel, Heat Treated, Inch Dimensions 120 Ksi And 150 Ksi Minimum Tensile Strength, And Metric Dimensions 830 MPa And 1040 MPa Minimum Tensile Strength," unless otherwise indicated on the drawings.
         1) Tighten nuts for Bolts in accordance with CBC Sections 1705A.2.1. Load Indicating Devices shall be pre-approved by the [DSA-SS], and certification by an independent testing laboratory stating that the devices meet AISC Specifications shall be submitted to Project Engineer and [DSA/SSS][HCAI][AHJ].
         2) Manufacturer shall also submit installation procedures prior to incorporation into the work for approval by the Project Engineer.
         3) Once approved, manufacturer's installation instructions shall be followed for all conditions. Mark bolts that have been completely tightened with an identifying symbol.
         4) Connections shall be slip-critical (SC) type, unless indicated otherwise on the drawings.
            a) Slip-critical connections, surfaces shall be in accordance with ASTM F 3125 "Standard Specification For High Strength Structural Bolts And Assemblies, Steel And Alloy Steel, Heat Treated, Inch Dimensions 120 Ksi And 150 Ksi Minimum Tensile Strength, And Metric Dimensions 830 MPa And 1040 MPa Minimum Tensile Strength."
         5) Contacting surfaces shall be painted, except for friction-type (SC) connections.
         6) Provide washers in accordance with ASTM F 3125 "Standard Specification For High Strength Structural Bolts And Assemblies, Steel And Alloy Steel, Heat Treated, Inch Dimensions 120 Ksi And 150 Ksi Minimum Tensile Strength, And Metric Dimensions 830 MPa And 1040 MPa Minimum Tensile Strength."
      c. Welding: The details of all joints, the technique of welding employed, the appearance and quality of welds made, and the methods used in correcting defective work shall conform to "AISC Specs," "AWS Code," Table 1705A.2.1.
         1) All "exposed-to-view" welds will be smooth and flush with no voids showing and still be in conformance with standards referenced herein.

2) All exposed to view butt welds shall be flush as connected members will allow. Minor defects and transitions in metal surfaces shall be filled and sanded out with an approved metal filler prior to painting.
3) Exposed fillet welds are acceptable "as is" provided the surface chevrons are shallow and have no abrupt protrusions.

3. Cutting Holes: The use of a cutting torch is permissible only if the metal being cut is not carrying stress during the operation and only with the prior approval of the Architect and DSA-SS for each specific condition.
4. Setting Plates: Set column base plates and leveling plates to correct elevations and temporarily support on steel wedges or shims until the supported members have been plumbed, locked in place and grouted.

C. Erection Sequence: Erect steel in accordance with special erection sequences where special erection sequences are indicated on the contract documents.
D. Before and during erection, keep all structural steel clean. Ship, handle and store steel in a manner to avoid injury to members. Steel members showing evidence to rough handling or injury will be rejected.
E. Mark each member with erection identification corresponding to mark shown on erection drawings. Carefully plan erection of structural steel so that no cutting and removal of material will be necessary. Do not torch burn in the field, unless specifically permitted by Engineer.
F. Provide sufficient bracing, shoring and guys to effect safe and satisfactory erection. Provide bracing and shoring capable of holding steel work plumb and properly aligned while field connections are being made, and until lateral force resisting elements are deemed by the Architect to be capable of bracing structure. Temporary bracing shall be adequate to resist lateral forces from wind or seismic prior to the completion of the lateral resisting system.
G. Set bearing and base plates with extreme care. Bring level, to line and grade with leveling plates or by leveling nuts and bolts. Grout solid under plates with a flowable non-shrink grout per Specification Section – CAST-IN-PLACE CONCRETE prior to applying vertical load.
H. Field Assembly: Set structural framing accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces which will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Shimming or other adjustments not indicated on drawings shall be approved by the Engineer prior to installation. Level and plumb individual members of the structure within specified AISC tolerances except as noted herein. Column shimming shall be 1/4 inch.

I. All welds shall be full and clean, and conform to AISC and AWS Specifications.
J. Erection Tolerances: Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
1. Individual pieces shall be erected so that the deviation from plumb, level and alignment shall not exceed 1 to 500 plus:
2. The maximum displacement of the center-line of columns adjacent to elevator shafts, from the established column line, shall not be more than 1 inch at any point from the established column line in the first 20 stories.
3. In order to provide a true, flat plane for the exterior elevations, install all steel framing at the exterior walls of the building, so that the center lines of such framing does not vary by more than 1 inch for the length of the building.
a. Also, install each vertical member on such grids so that its vertical center-line does not vary by more than 1/2 inch from a vertical line for each story and 1 inch for its full height.
4. Take special care that column base plates are parallel and perpendicular to faces of columns and that bolt holes are accurately placed.

K. Hoisting And Bracing:
1. Provide all hoisting and erecting equipment and power.

2. Provide and maintain any and all safety railings, toe boards, etc., required for the erection of steel framing and metal decking.
3. Brace the erected frame in a manner which will assure safety and proper alignment to receive the metal decking and until the concrete slabs have been poured and have set.
4. Erect building frame true and level. Erect columns in a manner to allow for movement due to welding shrinkage and thermal expansion and contraction of framing. Check for plumb after erection of each level. Maintain structural stability of frame during erection. Provide temporary bracing where necessary to maintain frame stability and to support required loads, including equipment and its operation.

3.4 ERECTION OF AESS

A. Take special care during erection to avoid marking or distorting the AESS and to minimize damage to shop painting. Set AESS accurately in locations and to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.
   1. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Take care to avoid any blemishes, holes, or unsightly surfaces resulting from the use or removal of temporary elements.
   2. Grind tack welds smooth.
   3. Remove backing and runoff tabs, and grind welds smooth.
   4. Orient bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
   5. Remove erection bolts in Category AESS 4 AESS, fill holes with weld metal or filler, and grind or sand smooth to achieve surface quality approved by Architect.
   6. Fill weld access holes in Category AESS 4 AESS with weld metal or filler and grind, or sand smooth to achieve surface quality as approved by Architect.
   7. Conceal fabrication and erection markings from view in the completed structure.

.In addition to ANSI/AISC 303, Section 10 requirements, comply with the following.

1. Erection of Category AESS 4:
   a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
   b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
   c. Remove weld spatter, slivers, and similar surface discontinuities.
   d. Grind off butt and plug weld projections larger than 1/16 inch (1.6 mm).
   e. Continuous welds are to be of uniform size and profile.
   f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
   g. Splice members only where indicated on Drawings.
   h. No torch cutting or field fabrication is permitted.
   i. Weld profiles, quality, and finish are be as approved by Architect.
   j. Make joint welds, including tack welds, appear continuous by filling intermittent welds.
   k. Grind welds smooth.
   l. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.
   m. Oversize welds where ground, contoured, or blended, and grind to provide a smooth transition, matching profile approved by Architect.

3.5 REPAIR / RESTORATION

A. Defective Work shall be immediately replaced with proper work. Such replaced Work and the Testing and Inspection for it shall be at the expense of the Contractor. If defects or damages

cannot be corrected in the field, the material shall be returned to the shop or new parts furnished, as the Architect directs, and the Contractor shall pay all costs therefor.

1. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780 "Practice for Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings."
2. Primer Coat - On all hot-dip iron or steel that needs repair, provide one primer coat of the following:
   a. Zinc Rich Galvanize No. 1141 by AERVOE INDUSTRIES, INC., or approved equivalent.
   b. Provide a smooth-flowing, high-solids compound that provides a fast-drying coating that protects ferrous metals in highly corrosive environments. Coating shall be 97% pure zinc metallic flake, which leaves 94% zinc in the dry film.
   c. Overall Dry Film Thickness: 2.0 mil.
3. Finish Coat - On all hot-dip iron or steel that needs repair, provide one finish coat over a properly cured primer coat of the following:
   a. Zinc Rich Galvanize No. 1141 by AERVOE INDUSTRIES, INC., or approved equivalent.
   b. Provide a smooth-flowing, high-solids compound that provides a fast-drying coating that protects ferrous metals in highly corrosive environments. Coating shall be 97% pure zinc metallic flake, which leaves 94% zinc in the dry film.
   c. Overall Dry Film Thickness: 2.0 mil.

B. Touch-up Primer Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop priming to comply with SSPC-PA1 "Touching Up Shop-Painted Surfaces."
   1. Clean and prepare surfaces by SSPC-SP 2 "Hand-Tool Cleaning" or SSPC-SP 3 "Power-Tool Cleaning."

3.6 FIELD QUALITY CONTROL

A. Site Tests:
   1. As required by Regulatory Requirements.

B. Tests, inspection:
   1. As required by Regulatory Requirements.
   2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
   3. No work shall be without the inspections required by Regulatory Requirements.
   4. Tests and inspection of field welding in accordance with CBC Table 1705A.2.1. Perform field welding only under supervision of welding inspector.
      a. Welds shall be in accordance with CBC Table 1705A.2.1.
      b. Inspection shall be in accordance with CBC Table 1705A.2.1.
         1) Welding inspector shall be an AWS Certified Welding Inspector (CWI).

C. Verification of Performance:
   1. Certification:
      a. The Contractor shall engage and pay for a registered Civil Engineer or Licensed Land Surveyor to check the alignment, plumbness, elevation, and overall accuracy of the erected framing at appropriate stages during construction and at completion of erection.
      b. Civil Engineer or Licensed Land Surveyor shall submit written verification and certification that the entire installation is in accordance with the Contract Documents.

END OF SECTION

SECTION 05 30 00 – METAL DECK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all Metal Deck materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 03 15 14 DRILLED ANCHORS
   4. 03 30 00 CAST-IN-PLACE CONCRETE
   5. 04 22 00 CONCRETE MASONRY UNITS
   6. 05 12 00 STEEL AND FABRICATIONS
   7. 06 10 00 ROUGH CARPENTRY
   8. 07 14 16 FLUID-APPLIED WATERPROOFING
   9. 07 21 00 INSULATION
   10. 07 40 00 METAL PANELS
   11. 07 51 13 BUILT-UP ROOFING
   12. 07 60 00 SHEET METAL
   13. 07 72 00 ROOF ACCESSORIES
   14. 07 84 00 FIRESTOPPING
   15. 07 92 00 SEALANTS
   16. 09 22 16 METAL FRAMING
   17. 09 50 00 ACOUSTICAL CEILINGS
   18. 09 91 00 PAINTING
   19. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   20. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with Specification Section – REGULATORY REQUIREMENTS and the following standards:
      a. AISC American Institute of Steel Construction.
      b. AISI American Iron and Steel Institute.
      c. ASTM American Society for Testing and Materials.
      d. AWS American Welding Society "Structural Welding Code."
      e. DOD Department of Defense
      f. ICC International Code Council
      g. SDI Steel Deck Institute.
      h. SSPC The Society for Protective Coatings

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product Data.
      a. Include all accessories such as Metal Trim, Flute Closure Trim, Neoprene Closure Tape, Joint Covers, and Sound Insulation Batts (sized to fit flute profile).
   2. Shop Drawings:

a. Indicate deck sheet layout and all installation details. Contract documents may not be used as shop drawings.

b. Manufacturer's specifications for each Deck Type.

c. Certification: Provide affidavits from the manufacturer listing mill test certificates by number for each size and type of decking.

d. Manufacturer shall provide affidavits of approval by the International Code Council (ICC) for the metal decking shapes proposed.

3. Quality Assurance/Control Submittals:
   a. Design Data.
      1) Submit manufacturer's design data indicating Metal Panel Section Properties (including gauge, weight in pounds per ft^2, I+ and I-(in^4/ft), S+ and S-(in^3/ft), and profile dimensions).
   b. Test Reports:
      1) Submit Steel Mill Test Reports for each heat establishing conformity with these Specifications in accordance with CBC Section 2202A.

      2) Submit five (5) copies of Shop and Field Welding Tests and Inspection Reports.
4. Closeout Submittals in accordance with Specification Sections in Division One:
   a. Project Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Material Qualifications:
      a. Materials shall be identified and tested in conformance with CBC Section 2202A.
   2. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.

      b. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
   3. Manufacturer/Supplier Qualifications:
      a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:

      a. Tests and Inspection of Shop and field welding shall be in accordance with CBC Sections 1705A.2, 2204A.1 and 2213A.2.
         1) Perform shop and field welding only under supervision of an AWS/CWI inspector, by welders recently qualified by Test as prescribed in AWS "Standard Qualifications Procedure," and per CBC Section 2205A and 2213A.
      b. When Metal Decking is part of a "listed" deck assembly as indicated on the drawings, provide Metal Decking units listed in Underwriter's Laboratories (UL) "Fire Resistive Directory," or other approved "Fire Resistive Directory," with each deck unit bearing the fire resistive label and marking for specific system detailed.

C. Certificates:

1. Provide a letter on Contractor's Letterhead certifying Work provided, meets or exceeds, the requirements of this Section.

1.5 SCHEDULING

A. Schedule the Work so that there will be no excessive inspection time. At all times that an inspector is required, sufficient work shall be laid out and adequate personnel supplied so that the Inspector's time will be used to full advantage. If inspection costs become excessive because of poor shop procedure, such excess costs will be paid for by the Owner, but deducted from the Contract Price. Poor procedures will be determined upon review of Inspection and/or Testing Reports. The rate for charging the excess costs will be as follows:
   1. Minimum of three (3) certified welders are used, Owner will pay 100 percent.
   2. Only two (2) certified welders are used, Contractor will be charged 1/3 of the Inspection cost.
   3. Only one (1) certified welder is used, the Contractor will be charged 2/3 of the inspection cost.

1.6 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written standard warranty:
      a. Warranty Period One (1) Year.

C. Installer's Warranty:
   1. In accordance with the terms of the Specification Section - WARRANTIES
      a. Warranty Period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
   1. Specified product manufacturer:
      a. VERCO DECKING, INC., A NUCOR COMPANY
      b. Acceptable alternative manufacturers:
         1) ASC PROFILES, LLC.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Structural:

1. Steel for galvanized Metal Deck Units shall be in accordance with ASTM A 653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process," grade as indicated on the drawings and in compliance with SDI specifications. The steel sheets shall have received, before being formed, a metal protective coating of Zinc conforming to ASTM A653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process" Class G60 coating.
2. Provide deck sections, type and gauge as indicated on the drawings. Other manufacturers producing deck complying with these Specifications, and having equivalent properties and dimensions will be subject to the Architect's review upon submission of substantiating data, and may be used only if equivalent to deck sections specified, in the Architect's opinion.
3. All deck units shall have an International Code Council (ICC) Evaluation Services Report.
   a. Diaphragm shear capacities shall be comparable (within 5%) to those listed on the drawings for the deck, welding, and spans indicated.
4. Units shall be in lengths to span over two or more supports. Where steel layout does not permit two-span minimums, notify the Structural Engineer prior to fabrication.
5. For limitations of loads to metal decking see section 01 84 15.
6. All deck units shall have male and female interlocking side joints. All deck units with concrete or insulating concrete shall be vented to provide 1% open area.
7. Prior to covering or filling metal decking, verify and coordinate installation requirements of suspended metal framing, suspended acoustical ceiling systems, mechanical and electrical work or other items as required. Provide inserts, clips, anchors or fasteners as indicated or as otherwise required to provide for the complete and proper installation of suspended items from the metal deck.
   a. Coordinate with Specification Section - ACOUSTICAL CEILINGS.
   b. Verify and coordinate locations, patterns, spacing, etc. of suspension members and connectors required by other Sections of the Specifications.
   c. Where suspension or hanger wires are required under other Sections, verify and coordinate locations, patterns, spacing, etc. with the appropriate trade. No loading other than suspended ceilings may be suspended from metal deck without concrete fill. Suspend all piping, ducting, conduit and equipment from steel beams.
8. Structural Properties: Deck shall have minimum structural properties as indicated on Structural Drawings.
9. Acoustical Properties: When Acoustical Decks are required, provide acoustical deck with the following properties:
   a. Vertical webs (except at side joint) shall be perforated with 5/32" diameter holes on staggered 7/16" centers to provide 0.85 Noise Reduction Coefficient (NRC). NRC of completed assembly shall be as determined by tests in accordance with ASTM C 423 "Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method."

2.3 ACCESSORIES

A. Miscellaneous Steel Shapes:
   1. Provide in accordance with Specification Section – STEEL AND FABRICATIONS, and ASTM A 36.

B. Shear Connectors:

1. Headed stud type, in accordance with ASTM A 108 "Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality," Grade 1015 or 1020, cold-finished carbon steel, with dimensions complying with AISC specifications.
   a. Tensile Strength: 60,000 psi.
   b. Elongation in 2 Inches: 20 percent.
   c. Reduction of Area: 50 percent.

C. Fabricated Sheet Metal:
1. Provide in accordance with Specification Section - SHEET METAL and ASTM A 653, commercial quality, galvanized.
   a. Cell closures where shown on Drawings.
   b. Light gauge plate fillers attached to deck to provide an uninterrupted roof plane.
   c. Drain sumps and/or roof drain mounting plates as detailed.
   d. Miscellaneous accessories incidental to erection of deck.

D. Acoustical Insulation: Glass fiber type, 1-1/2" thick, in accordance with ASTM C 665 "Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing," Type I, Class A, sized to fit the appropriate flute profile.

E. Welding Rods: E60XX minimum.

2.4 FABRICATION

A. Shop Assembly:

B. Form metal deck units in lengths to span three or more supports, with flush, telescoped, or nested 2-inch laps at ends and interlocking or nested side laps, of metal thickness, depth, and width as indicated.
   a. Roof Deck Units:
      1) Provide deck configurations that comply with SDI "Roof Deck Design" current edition.
2. Accessories:
   a. Metal Cover Plates:
      1) Fabricate metal cover plates for end-abutting floor deck units of not less than same thickness as decking.
      2) Form to match contour of deck units and approximately 6-inches wide.
   b. Metal Closure Strips:
      1) Fabricate metal closure strips, for cell raceways and openings between decking and other construction, of not less than 0.045-inch (18 gauge) sheet steel.
      2) Form to provide tight-fitting closures at open ends of cells or flutes and sides of decking.
      3) Continuous closures parallel and over beam flanges are not allowed.
      4) Fabricate Profiled Metal Closure Strips for exposed "top of wall" connections and similar conditions where flutes are to be closed to view on underside of deck.
   c. Roof Sump Pans:
      1) Fabricate from single piece of 0.071-inch (14 gauge) minimum galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain.

2) Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3-inches wide.

3) Recess pans not less than 1-1/2 inches below roof deck surface unless otherwise shown or required by deck configuration.

4) Holes for drains shall be cut in the field.

2.5 FINISHES

A. Hot-Dip Galvanizing (both sides of metal deck):
1. Zinc coatings on iron and steel products in accordance with ASTM A 123 "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."
2. Zinc coatings on iron and steel hardware shall be in accordance with ASTM A 153 "Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware."
3. Galvanized repair paint: High-Zinc-Dust-Content, in accordance with SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight paint for re-galvanizing welds and repair painting galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:
1. Prior to the execution of the Work under this specification section, inspect the installed Work executed under other specification sections of this Project Manual which affect the execution of Work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin Work until unacceptable conditions have been corrected.
3. Execution of Work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
1. Coordinate Work under this specification section with Work specified under other specification sections to ensure proper and adequate interface of Metal Decking Work specified under this specification section.

B. Protection:
1. Protect all adjacent surfaces from drips, spray, welding burns, and other damage from Work under this specification section.

C. Surface preparation:
1. Prepare surface of metal decking for any additional finish as indicated on the drawings in accordance with manufacturer's written instructions and recommendations.

3.3 INSTALLATION

A. General:
1. In accordance with Regulatory Requirements.

2. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
3. In accordance with approved shop drawings.
4. Set plumb, level, and square to supports.

B. Layout:
1. Lines shall be straight and true without deformations, creases, wrinkles or noticeable defects.
2. Provide one deck unit continuous over two (2) supports, minimum, unless noted otherwise.
3. Abut end joints neatly at centerline of support.
4. Bend decking to conform to slopes and warps as required for solid contact to framing that allows proper welding.
5. All deck units shall break over beams.
6. Provide low ribs at all beams parallel to deck. As an alternate, the deck may be broken and in-filled with a flat pan to provide deck welding to parallel beams.
7. Butt deck units tight over steel beams.

C. Minimum Fastening Requirements:
1. Fasten in accordance with the structural drawings and/or manufacturer's written recommendations whichever is most restrictive by use of 15/16" visible diameter (1/2" effective diameter) fusion welds.
2. Roof Deck units shall be fastened to resist gross uplift loading in accordance with CBC Section 1609A.
3. The metal deck shall be fastened to all structural members both parallel and perpendicular. Spread deck and modify layout where structural members are parallel to the metal deck ribs.

D. Cutting and Fitting:
1. Cut and neatly fit deck units and accessories around other Work projecting through or adjacent to the decking, and support of other Work shown.
2. Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other Work shown.
3. Provide DSA-SS approved hanger slots or clips between cells of flutes of lower element where floor deck units are to receive hangers for support of ceiling construction, air ducts, diffusers, or lighting fixtures.
    a. Hanger clips designed to clip over male side lap joints of floor deck units that are approved by DSA-SS may be used instead of hanger slots.
    b. Local slots or clips at no more than 14-inches o.c. in both directions, not over 8-inches form walls at ends, and not more than 8-inches form walls at sides, unless otherwise indicated on the drawings.
    c. Provide manufacturer's standard hanger attachment devices provided they are in accordance with IR 25 or IR 25-3, and approved by DSA-SS.

E. Provide metal joint covers at abutting ends and changes in direction of floor deck units, except where taped joints are required.

F. Provide roof sump pans over openings provided in roof decking and weld to top decking surface. Space welds not more than 12-inches o.c. with at least one weld at each corner.

G. Weld shear connectors to supports through decking units as shown on the structural drawings.

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1. Do not weld shear connectors through two layers (lapped ends) of decking units.
2. Weld only on clean, dry deck surfaces.

H. Provide metal closure strips at open uncovered ends and edges of roof decking and in voids between decking and other construction.
1. Weld into position to provide a complete decking installation.
2. Continuous closure perpendicular to flutes not allowed.

3.4 REPAIR / RESTORATION

A. After decking installation, wire brush, clean, and paint scarred areas, welds, and rust spots on top and bottom surfaces of decking units and supporting steel members in accordance with ASTM A 780 "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings."
1. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's written instructions.
2. Touch-up painted surfaces with same type of shop paint used on adjacent surfaces.
3. In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.
4. Clean surfaces of installed deck by effective means to receive sprayed-on fireproofing or finish painting as indicated.

3.5 FIELD QUALITY CONTROL

A. Site Tests:
1. As required by Regulatory Requirements.
a. Inspection of installation as per Specification Section – TESTING LABORATORY SERVICES.

B. Inspection:
1. As required by Regulatory Requirements.
2. Schedule inspections and notify the Architect, Owner's Inspector and any regulatory agencies of the time at least 48 hours prior to the inspection.
3. No Work shall be without the inspections required by Regulatory Requirements.
4. All materials, methods and equipment shall be subject to inspections by the Testing Laboratory at any time.
5. Welding Inspection: Welding of metal deck shall be performed under the inspection of the Testing Laboratory. Inspection shall conform to CBC Section 1705A.
6. Examine areas to receive work specified. Do not begin work until underlying work is complete, all required inspections have been made, and all conditions, which might prevent proper installation or impair performance of work have been corrected.
7. Beginning installation means accepting conditions of underlying work.
8. If supporting steel work is not properly aligned or sufficiently level to permit proper bearing of metal decking, such deficiency shall be corrected by the Contractor before placing units.

C. Defective Deck:
1. Units of decking that become deformed or damaged to such extent that they are weakened or unsuitable for use shall be removed and replaced at no cost to the Owner.

3.6 CLEANING

A. Cleaning:
1. Clean in accordance with Specification - PROJECT CLOSEOUT.
a. Clean all surfaces of Metal Deck to receive concrete fill as required to assure adequate bond in accordance with manufacturers requirements.

b. Clean all surfaces of Metal Deck prior to painting.

END OF SECTION

SECTION 061000 – ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Provide all material, labor, equipment and services necessary to complete all rough carpentry, accessories and other related items necessary to complete the Project as indicated by the Construction Documents unless specifically excluded.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 11 01 CONCRETE FORMWORK
4. 03 15 14 DRILLED ANCHORS
5. 03 30 00 CAST-IN-PLACE CONCRETE
6. 04 22 00 CONCRETE MASONRY UNITS
7. 05 12 00 STEEL AND FABRICATIONS
8. 05 30 00 METAL DECK
9. 06 41 23 MODULAR CASEWORK
10. 07 21 00 INSULATION
11. 07 40 00 METAL PANELS
12. 07 51 13 BUILT-UP ROOFING
13. 07 60 00 SHEET METAL
14. 07 72 00 ROOF ACCESSORIES
15. 07 92 00 SEALANTS
16. 08 11 00 METAL DOORS AND FRAMES
17. 08 31 13 ACCESS DOORS AND FRAMES
18. 08 33 00 COILING DOORS
19. 08 41 00 STOREFRONTS
20. 08 70 00 HARDWARE
21. 09 22 16 METAL FRAMING
22. 09 24 00 CEMENT PLASTER
23. 09 29 00 GYPSUM BOARD
24. 09 30 00 TILE
25. 09 50 00 ACOUSTICAL CEILINGS
26. 09 64 29 HARDWOOD FLOOR
27. 09 65 10 RESILIENT BASE AND ACCESSORIES
28. 10 05 00 MISCELLANEOUS SPECIALTIES
29. 10 11 00 VISUAL DISPLAY BOARDS
30. 10 14 00 IDENTIFYING DEVICES
31. 10 28 13 TOILET ACCESSORIES
32. 10 44 00 FIRE PROTECTION SPECIALTIES
33. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:
1. In accordance with the following standards:
a. ALSC American Lumber Standards Committee

b. ANSI American National Standards Institute
c. APA The Engineered Wood Association (Formerly the American Plywood Association)
d. ASME American Society of Mechanical Engineers International
e. AWPA American Wood Protection Association
f. CABO Council of American Building Officials
g. FS Federal Specification
h. ICC International Code Council
i. NDS National Design Specification for Wood Construction
j. NIST National Institute of Standards and Technology
k. PS Product Standards of the U.S. Department of Commerce
l. RIS Redwood Inspection Service
m. WCLIB West Coast Lumber Inspection Bureau
n. WWPA Western Wood Products Association

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
1. Product Data:
a. Submit manufacturer's data for Wood-Preservative Treatment.
b. Submit manufacturer's data for Fire-Retardant Treatment.
c. Submit manufacturer's data for power driven fasteners, metal-framing connectors, and metal framing anchors.
2. Quality Assurance/Control Submittals:
a. Material Certificates: Submit Material Certificates of Compliance to Standards and Regulatory Requirements.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Installer Qualifications:
a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA), in the area where the project is located.

C. Meetings:
1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
a. Coordinate the work with other work being performed.
b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
a. Review for proper installation of work progress.
b. Identify any installation problems and acceptable corrective measures.
c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.

a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
b. Maintaining installed work until the Notice of Substantial Completion has been executed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver undamaged products to project site in manufacturer's sealed containers or bundles with tags and labels intact.

B. Storage and Protection:
1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
2. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.6 PROJECT CONDITIONS

A. Environmental Requirements:
1. Dust Control: Perform work in a manner as to minimize the spread of dust and flying particles.
2. Burning: No burning will be allowed on-site.
3. Rain: Work under this section shall not be started or maintained under threat of rain unless the work is not affected by the rain.

B. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

1.7 WARRANTY

A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
1. In accordance with manufacturer's written standard warranty:
a. Warranty Period One (1) Year.

C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES
a. Warranty Period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Power Driven Fastener specified product manufacturer:
   a. HILTI FASTENING SYSTEMS.
2. Metal Framing Anchor specified product manufacturer:
   a. SIMPSON STRONG-TIE COMPANY.
   b. Acceptable alternative manufacturers:
      1) Manufacturers of Alternative Metal Framing Anchors shall have Model Code Research Evaluation Reports and Published allowable design loads that are determined from empirical data, or by rational engineering analysis, that are demonstrated by comprehensive testing performed by a qualified testing agency acceptable by the Architect or its Designated Design Consultant, and DSA.

~~3. Metal Timber Framing Connector specified product manufacturer:~~
~~a. SIMPSON STRONG-TIE COMPANY.~~
~~b. Acceptable alternative manufacturers:~~
~~1) Do not substitute connectors manufactured by others than SIMPSON STRONG-TIE COMPANY without prior written review by the Architect or its Designated Design Consultant, and DSA.~~

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Wood:
1. Douglas Fir - Larch:
   a. Standards and Requirements: In accordance with WCLIB "Standard Grading and Dressing Rules" No. 17, latest edition, and WWPA "Western Lumber Grading Rules," latest edition.
      1) All wood shall be "DRY" and having a moisture content of less than 19 percent at the time of installation, in accordance with WWPA.
      2) Provide wood of S4S unless otherwise noted.
      3) Factory mark each piece of wood with the grade stamp of the grading agency.
   b. Grading and Use Requirements:

Item	Sizes	Grade	Maximum Moisture Content at Initial Use (Installation)
Studs	2x	No. 1	19%
Studs	3x, 4x, 6x	No. 1	19%
Sills & Plates	2x	No. 1	19%
Sills & Plates	3x, 4x, 6x	No. 1	19%

Item	Sizes	Grade	Maximum Moisture Content at Initial Use (Installation)
Beams	4x, 6x	No. 1	19%
Joists	2x	No. 1	19%
Posts	4x, 6x, 8x	No. 1	19%
Ledgers	2x	No. 1	19%
Ledgers	3x, 4x, 6x	No. 1	19%
Blocking	2x, 3x, 4x, 6x	No. 1	19%
Sheathing and Stripping	Up to 1-1/2" thick 2" width and wider	No. 1	19%
Stripping	2x, 3x, 4x, 6x	Construction	19%
Nailers & Grounds	2x, 3x, 4x, 6x	Construction	19%
Furring	2x, 3x, 4x, 6x	Construction	19%
T & G Decking	2x	Select Dex	15%

1) Initial use shall be that point at which screws or other fasteners or the holes for said fasteners are installed into the wood.
2) The Contractor shall use whatever means necessary, including site drying to ensure that the moisture contents listed above are not exceeded.

B. Plywood:
1. Soft Plywood:
a. Standards and Requirements: In accordance with PS1-09, Group 1 Douglas-Fir and PS2-10.
1) Factory mark each piece of plywood with the APA Grade Stamp.
2) Maximum Moisture Content at Initial Use (Installation) shall be 15 percent.
b. Grading and Use Requirements:
1) Wall, Roof, and Parapet Sheathing:
a) APA Rated Sheathing - Structural 1.
b) Span Rating as required to suit stud or joist spacing.
c) Exposure Durability Classification - Exposure 1.
d) Species Group 1.
e) Grade C-C 3 ply for 1/4 inch thickness and C-D 5 ply for 1/2 and 5/8 inch thickness.
f) Fire Retardant Treated.
2) Subflooring, Floor Sheathing as underlayment, Equipment Platform Sheathing:
a) APA Rated "Sturdi-Floor."
b) Span Rating as required to suit joist spacing.
c) Exposure Durability Classification - Exposure 1.
d) Species Group 1.
e) Grade C-C plugged.
f) Fire Retardant Treated.
3) Backing panels for Electrical Equipment.
a) APA Rated Sheathing - Structural 2.
b) Exposure Durability Classification - Exterior.
c) Species Group 1.
d) Grade C-C.
e) Shall be 3/4 inch minimum thickness.
f) Fire Retardant Treated.
4) Backing panels for Telecommunication Equipment:
a) APA Rated Sheathing - Structural 2.
b) Exposure Durability Classification - Exterior.

c) Species Group 1.
d) Grade A-B.
e) Shall be 3/4 inch minimum thickness.
f) Fire Retardant Treated.

2.3 FINISHES

A. Preservative Treatment:
1. Pressure Treat Wood and Plywood, with CARB Complying, EPA Registered, preservatives in accordance with AWPA Standards "U," "T," and "P."
   a. Do not use material that does not comply with the requirements for untreated material.
   b. After treatment, kiln-dry wood to a maximum moisture content of 19 percent.
   c. After treatment, dry plywood to a maximum moisture content of 15 percent.
   d. Factory mark each treated item with the treatment quality mark of an Independent Inspection Agency approved by the ALSC Treated Wood Program.
2. Non-pressure treat Wood and Plywood, with CARB Complying, EPA Registered preservatives in accordance with AWPA Standards "U","T,""P," • and "N."

B. Fire Retardant Treatment:
1. Fire Retardant Treat Wood and Plywood with pressure treatment materials that comply with performance requirements of CBC 2303.2.
   a. Use Exterior Type.
   b. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures when tested by a qualified independent testing agency and is acceptable to Fire and Life Safety authorities.
   c. Use treatment that does not promote corrosion of metal fasteners.
   d. After treatment, kiln-dry wood to a maximum moisture content of 19 percent.
   e. After treatment, dry plywood to a maximum moisture content of 15 percent.
   f. Factory mark each treated item with the treatment quality mark of an Independent Inspection Agency.

2.4 ACCESSORIES

A. Fasteners: All types shall comply with standards and dimensions of the latest edition of NDS. All types of fasteners exposed to wet or exterior conditions, in-ground contact, in pressure or preservative treated woods, in concrete or masonry, or in an area of high relative humidity shall be hot-dipped galvanized in accordance with ASTM A 153 "Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware."
1. Nails: Common wire nails or spikes complying with ASTM F 1667 "Specification for Driven Fasteners: Nails, Spikes, and Staples," and CBC Section 2304.10. Box nails and sinker nails are not permitted. Vinyl coating is permitted on common nails.
2. Bolts: Steel bolts complying with ASTM A 307 "Specification for Carbon Steel Bolts and Standards, 60,000 PSI Tensile Strength," Grade A, hex head.
   a. Provide hex head nuts complying with ASTM A 307 "Specification for Carbon Steel Bolts and Standards, 60,000 PSI Tensile Strength," and standard flat washers complying with ANSI/ASME B18.22.1, Type A, Wide pattern.
3. Lag Bolts: Shall comply with ANSI/ASME B18.2.1, hex head.
   a. Provide standard flat washers complying with ANSI/ASME B18.22.1, Type A, Wide pattern.
4. Wood Screws: Shall comply with ANSI/ASME B18.6.1.

a. Screws for fastening wood to Metal Framing shall comply with ASTM C 954 "Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness."

5. Power Driven Fasteners: Tempered Steel pins with corrosive resistant plating or coating complying with ICC ESR-1539.

B. Metal Framing Anchors: All anchors shall comply with ASTM A 653 "Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process," G60 Coating Designation for hot-dipped zinc-coated steel sheet. Provide structural, commercial, or lock-forming quality as standard with manufacturer for type of anchor indicated.

~~C. Metal Timber Framing Connectors: All connectors shall have specific ICC Approval and be fabricated from hot-dipped galvanized steel.~~

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual, which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.
4. Verify that work under this Section may be performed in strict accordance with the original design and all pertinent codes and regulations.

3.2 PREPARATION

A. Coordination:
1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:
1. Protect all materials from damage occurring from work called for under this specification section.

C. Preservative Treatment:
1. Members requiring pressure treatment:
   a. Sills, Plates, Ledgers, Studs, Joists, Blocking, Nailers and Furring attached or resting on or against concrete or masonry construction.
   b. Pressure treated members cut in the field shall have the cut ends painted with preservative until the wood or plywood absorbs no more preservative.
2. Members requiring field treatment:
   a. All wood and plywood members at exterior walls within two feet of the ground surface.
   b. Treat all surfaces of the member.

c. Treat by dipping the required portion of the member into preservative for 15 minutes or paint until the wood or plywood absorbs no more preservative. Wait a minimum of two hours after dipping or painting is complete to incorporate member into project.
d. Test treat items for compatibility where additional finish coats (stain or paint) may occur.

D. Fire Retardant Treatment:
1. All wood and plywood members as indicated.
2. All plywood panels for Telecommunication Equipment.

3.3 INSTALLATION

A. General:
1. In accordance with manufacturer's instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Selection of wood and plywood pieces:
   a. Carefully select all members.
   b. Select individual pieces so that knots and obvious defects will not interfere with placing bolts, proper nailing, and making proper connections.
   c. Cut out and discard all defects which will render a piece unable to serve its intended function.
   d. Wood and plywood may be rejected by the Architect or its Designated Design Consultant, and DSA whether or not it has been installed for excessive warp, twist, bow, crook, mildew, fungus, or mold as well as for improper cutting, fitting and treatment when required.
5. All wood and plywood shall be accurately cut to lengths required.
6. All work shall produce joints true, tight, level, plumb, and all members are securely anchored.
   a. Do not shim any framing member.

B. Layout:
1. Lines shall be straight and true.

C. Fastening:
1. Nails:
   a. All nailing shall be as required by CBC Table 2304.10.2 "Fastening Schedule."
   b. Machine nailing may be approved subject to the approval of the Architect or its Designated Design Consultant, and DSA.
      1) The use of machine nailing is subject to a satisfactory job site demonstration for each project. The approval is subject to continued satisfactory performance.
      2) In plywood, if the nail heads penetrate beyond flush with the surface of the sheathing, or if minimum allowable edge distances are not maintained, the performance will be deemed unsatisfactory.
      3) Machine nailing will not be accepted in 5/16" plywood.
   c. Penetration of nails or spikes shall be one-half the length of the nail or spike into the piece receiving the point.
   d. 16d nails shall be used to connect pieces 2" in thickness unless otherwise indicated.
   e. Clinch nails protruding through members.
   f. Bore holes for nails where necessary to prevent splitting.
   g. Use Finish or Casing Nails for finish work.

2. Lag Bolts:
   a. Lag Bolts shall be screwed into place. No driving is allowed.
   b. For the Shank portion, holes shall be bored the same depth and diameter as the shank. For threaded portion, holes shall be between 60% and 75% of the shank diameter.
   c. Malleable Iron or Steel plate washers shall be used where bolt heads bear on wood or plywood. Washers shall have an area equal to 16 times the area of the bolt.
      1) Steel plate washers shall have a thickness not less than 1/10 the length of the washer's longest side.
      2) Malleable Iron washers shall have a bearing surface for the head equal in diameter to not less that the long diameter of the head.
   d. Tighten all bolts and screws prior to concealing within structure.
3. Bolts:
   a. Holes shall be 1/16" larger than bolt diameter.
   b. Malleable Iron or Steel plate washers shall be used where bolt head and nuts bear on wood or plywood. Washers shall have an area equal to 16 times the area of the bolt.
      1) Steel plate washers shall have a thickness not less than 1/10 the length of the washer's longest side.
      2) Malleable Iron washers shall have a bearing surface for the head or nut equal in diameter to not less that the long diameter of the head or nut.
   c. Tighten all bolts prior to concealing within structure.
4. Power Driven Anchors
   a. Fastening shall be accomplished by low-velocity piston-driven power activated tool.
   b. Pins shall have guide washers to accurately control penetration.
5. Expansion Anchors (Post-Installed Concrete Anchors):
   a. Refer to Specification Section - DRILLED ANCHORS.
6. Metal Framing Anchors
   a. Use half-length nails where required or indicated.
~~7. Metal Timber Framing Connectors~~
   ~~a. Nailing shall conform to manufacturer's instructions with a nail provided for each punched hole.~~

~~D. Sills:~~
~~1. Shall be in long lengths of sizes as indicated.~~
~~2. Fasten with a minimum of two (2) anchor bolts per piece and bolt within 9", but not nearer than 6", from the end of piece.~~
~~3. Malleable iron or steel plate washers shall be placed under anchor bolt nuts bearing on wood.~~
~~4. Set Sill level and true.~~

~~E. Studs and Posts:~~
~~a. Shall be full length.~~
~~2. Cut members to provide full bearing at ends.~~

~~F. Plates:~~
~~1. Shall be in long lengths and spliced as indicated.~~

~~G. Joists and Beams:~~
~~1. Shall be in long lengths and spliced over bearings unless otherwise indicated. Do not overcut.~~
~~2. Install with crown side up.~~

~~3. Beams or headers indicated to be built-up of two or more joists shall be constructed on the project site using full length members.~~

~~H.~~D. Blocking:

1. Blocking shall be same thickness and width of studs or joists unless otherwise indicated.
2. Install blocking at all wall, floor, or roof penetrations.
   a. Blocking shall provide surface for fastening applied interior or exterior flashings or flanges.
3. Install blocking at all plywood joints.
   a. Install blocking at plywood edges including crickets and parapet wall bracing.
4. Shall be provided for all fixtures, equipment, casework, toilet partitions, toilet accessories, handrails, visual display boards, identifying devices, finish hardware, flashing, wall and ceiling finishes, and other items as indicated. See also Specification Section - OWNER FURNISHED ITEMS for listing of N.I.C. items that will require blocking coordination.
   a. Coordinate placement of blocking and supports with manufacturer or supplier of items.

~~5. Fireblocking shall be provided to cut off all horizontal and vertical concealed draft openings in accordance with CBC Section 718.2.~~
   ~~a. Horizontal Fireblocking in walls shall be typically placed at 4'-0" above finished floor, at 8'-0" above finished floor, at mezzanine floor plane unless otherwise indicated, and at ceiling line plane.~~

~~6. Bridging shall be installed in all joist members deeper than 8 inches unless otherwise indicated.~~
   ~~a. Bridging shall extend the full depth of the joists.~~
   ~~b. Drill bridging within attics to provide ventilation as indicated.~~

~~I.~~E. Plywood Sheathing Panels:

1. For panels with different veneer face grades, the exposed face shall always be the higher grade.
2. Space panels 1/8 inch at all edge and end joints, and in accordance with APA.
3. Panels shall be applied with the long dimension (or strength axis) across the framing.
4. Fasten from the field of the panel first and then to the ends and edges to reduce stressing of the panel surfaces.
5. Center all joints over bearing supports.
6. Wall panels shall continue uninterrupted by ceilings or soffits from floor to floor or roof unless otherwise indicated.

~~J.~~F. Sheathing:

1. Shall be in accordance with the following:
   a. Wall Sheathing: CBC Section 2304.6 and Table 2304.6.1.
   b. Floor and Roof Sheathing: CBC Section 2304.8.
   ~~c. Structural Floor Sheathing: CBC Section 2304.8.1.~~
   ~~d.~~c. ~~Structural~~ Roof Sheathing: ~~CBC Section 2304.8.2.~~
   ~~e. Lumber Decking: CBC Section 2304.9.~~

~~K.~~G. Nailers and Grounds:

1. Shall be installed as indicated and where required for attaching other work.
2. Form to shapes indicated.
3. Coordinate locations with other work involved.
4. Provide nailers at all flashing and edge terminations when required by roofing manufacturer for metal and concrete roof decks. When the roof system is required to be Class A use fire-retardant treated wood.

5. Provide permanent Grounds of dressed, pressure-preservative-treated, Key-beveled wood and of thickness required to bring face of ground to exact finish thickness of finish material. Remove temporary grounds when no longer required.

~~L.~~H. Furring and Stripping
1. Shall be installed as indicated and where required to provide fastening material or space for the passage of pipes, conduits, etc. not accommodated including ceiling stripping.

~~M.~~I. Sealant:
1. When indicated, Primer shall be in accordance with sealant manufacturer recommendations.
2. When indicated, Joint Sealer shall be in accordance with Specification Section - SEALANTS.

3.4 CONSTRUCTION

~~A. Draftstopping:~~
~~1. Shall be provided in floor, attic, and ceiling areas in accordance with CBC Section 718.3 and 718.4.~~

~~B.~~A. Pipes:
1. Frame to avoid cutting or drilling for passage of pipes, ducts, and conduit.
2. Follow criteria as indicated for cutting or drilling. Unusual edge distances and awkward spacing and sizes shall be brought to the Architects attention for remedy.

~~C.~~B. Chimneys and Flues:
1. Keep all framing 2 inches away from chimney or flues in accordance with CBC Section 2304.5.

~~D. Cant Strips and Crickets:~~
~~1. Shape to sizes indicated.~~
~~2. Rigidly fasten to construction.~~
~~3. Block all joints of plywood panel construction.~~
~~4. Form neat and mitered corners.~~

~~E.~~C. Temporary Enclosures:
1. Provide and maintain all barricades and enclosures required to protect the work in progress.

~~F.~~D. Shoring or Bracing:
1. Shore or brace for temporary support of all work as required during the construction period except any shoring and bracing specified and included under other sections of this Project Manual.

~~G. Wood Curbs for Equipment:~~
~~1. Construct all wood curbs for roof mounted equipment.~~
~~2. Provide all miscellaneous blocking, bracing, supports, and other wood items to complete the work.~~

3.5 FIELD QUALITY CONTROL

A. Site Tests:
1. As required by Regulatory Requirements.

2. Project Inspector shall verify by means of a handheld moisture content meter that all wood and plywood supplied at the time of incorporation into structure(s) has met applicable moisture content requirements.
3. Project Inspector shall test all stud cavity walls to ensure that studs are a maximum of 19 percent moisture content prior to any other construction that encloses the wall cavity.

B. Inspection:
1. As required by Regulatory Requirements.
2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
3. No work shall be without the inspections required by Regulatory Requirements.

3.6 CLEANING

A. Removal of Debris:
1. Remove all Wood, including form lumber, chips, shavings and sawdust in or on the ground from the areas inside buildings. Do not bury debris in fill.

END OF SECTION

SECTION 06 22 00 – MILLWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Furnish all material, labor, equipment and services necessary to furnish Millwork, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 30 00 CAST-IN-PLACE CONCRETE
4. 06 10 00 ROUGH CARPENTRY
5. 06 41 23 MODULAR CASEWORK
6. 06 61 16 SOLID SURFACING
7. 08 70 00 HARDWARE
8. 09 65 10 RESILIENT BASE AND ACCESSORIES
9. 09 91 00 PAINTING
10. 10 05 00 MISCELLANEOUS SPECIALTIES
11. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:

1. In accordance with the following standards:
   a. AWS "Architectural Woodwork Standards," Latest Edition, including latest amendments, by the Architectural Woodwork Institute, Architectural Woodwork Manufacturers Association of Canada, and the Woodwork Institute.
   b. DOC U.S. Department of Commerce
   c. ICC International Code Council
   d. NIST National Institute of Standards and Technology
   e. NWMA "Industrial Standard" National Woodwork Manufacturer's Association.
   f. PS Product Standard (as issued by the DOC)
   g. WI Woodwork Institute.

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Shop Drawings.
   a. Submit shop drawings showing fabrication and installation of the work of this section including plans, elevations, sections, details of components, and attachments to other units of work.
2. Samples.
   a. Provide 6 inch square sample of each color and pattern selected.

1.4 QUALITY ASSURANCE

A. In accordance with Specification Section - REGULATORY REQUIREMENTS.

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1.5 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection:

1. Millwork shall not be delivered to the Project until the Work is sufficiently complete to properly accept, store and protect Millwork.

1.6 PROJECT CONDITIONS

A. Environmental Requirements:

1. Dust control: Perform work in a manner as to minimize the spread of dust and flying particles. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other on-site work.
2. Burning: No burning will be allowed on-site.
3. Temperature: Maintain ambient temperature in space to receive products between fifty (50) degrees Fahrenheit and ninety (90) degrees Fahrenheit for seven (7) days prior, during, and seven (7) days minimum following installation. Inform the Owner of ambient temperature requirements for products installed and maintain until Substantial Completion and turn over of the building or facility to the Owner.
4. Humidity: Maintain relative humidity in space to receive products between 45 percent and 65 percent at 60 degrees to 90 degrees F, and EMC (Equilibrium Moisture Content) conditions between 8 percent and 12 percent for 72 hours minimum prior, during, and following installation in accordance with manufacturer's written recommendations.

B. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

1.7 WARRANTY

A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:

1. In accordance with manufacturer's written standard warranty:
   a. Warranty Period One (1) Year.

C. Installer's Warranty:

1. In accordance with the terms of the Specification Section - WARRANTIES
   a. Warranty Period One (1) Year.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wood:

1. Use new, kiln-dried, clean stock lumber of the species and grades as scheduled or specified. Moisture content from time of Manufacture until time of installation shall be a minimum of 5 percent and shall not exceed 10 percent up to 2" nominal thickness and shall not exceed 19 percent for pieces thicker than 2" up to 9" nominal thickness.
2. Horizontal Planks, Wood Panels and Wood Shelf: :
   a. Standing and Running Trim for transparent finish: Provide species, sizes and patterns shown on the drawings; complying with the following grade requirements of referenced woodworking standard, for quality of materials and manufacture:

b. Quality of work Custom.
c. Species:
    1) Clear, kiln-dried hardwoods as described below:
        a) Species and Cut: Plain-sawn, clear, kiln-dried Birch selected for compatible grain and color (see drawings for locations).
    2) Texture: Surfaced (Smooth).
    3) Lumber for Transparent Finish (Stained -): Solid lumber stock.
    4) Refer to Interior Color Schedule of Stain Color.
d. .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:
    1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
    2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
    3. Execution of work under this specification section shall constitute acceptance of existing conditions.
    4. Job Measurement:
        a. Take field measurements as required and be responsible for verification of space available. Report any discrepancy between Drawings and field dimensions to the Architect.

3.2 PREPARATION

A. Coordination:
    1. Cooperate with Work performed under other sections as required to produce a satisfactory installation conforming to the full intent of the Drawings, Specifications, and the referenced standards.

3.3 INSTALLATION

A. Installation shall be in accordance with WI Custom standards.

END OF SECTION

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SECTION 064123 – MODULAR CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Provide all material, labor, equipment and services necessary to completely install all Modular Casework materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
a. Plastic laminate-faced casework.
b. Adjustable shelf supports:Metal Shelf Standards
c. Plastic Laminate countertops.
d. Solid-Surface countertops.
e. Solid-surface fabrications.
f. Plastic fabrications.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 15 14 DRILLED ANCHORS
4. 03 30 00 CAST-IN-PLACE CONCRETE
5. 04 22 00 CONCRETE MASONRY UNITS
6. 05 12 00 STEEL AND FABRICATIONS
7. 06 10 00 ROUGH CARPENTRY
8. 06 22 00 MILLWORK
9. 07 60 00 SHEET METAL
10. 08 70 00 HARDWARE
11. 09 22 16 METAL FRAMING
12. 09 29 00 GYPSUM BOARD
13. 09 65 10 RESILIENT BASE AND ACCESSORIES
14. 09 65 19 RESILIENT TILE
15. 09 68 40 CARPET
16. 09 72 00 WALL COVERINGS
17. 09 91 00 PAINTING
18. 10 05 00 MISCELLANEOUS SPECIALTIES
19. 11 40 00 FOOD SERVICE EQUIPMENT
20. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:
1. In accordance with the following standards:
a. BHMA BHMA stands for Builders Hardware Manufacturers Associates, Inc.
b. NAAWS "North American Architectural Woodwork Standards," Latest Edition, including latest amendments, by the Architectural Woodwork Institute, Architectural Woodwork Manufacturers Association of Canada, and the Woodwork Institute.
c. NEMA National Electrical Manufacturers' Associates, Publication Number LD3, latest-edition
d. NIST National Institute of Standards and Technology

e. NWMA "Industrial Standard" National Woodwork Manufacturer's Association.
f. PS Product Standard of the U. S. Department of Commerce
g. WI Woodwork Institute

1.3 DEFINITIONS

A. Refer to NAAWS.

B. Exposed Portions:
1. Face members and edges of cabinets (cabinet fronts), such as face plates, drawer fronts, door fronts, front edge of shelves.
2. Interior faces of cabinet doors.
3. Underside of bottoms of upper cabinets, 48" above finished floor.
4. Cabinet tops:
a. Under 72" above finish floor.
b. Visible from upper building level.
5. Interior surfaces (including top, bottom, and front of shelves) of open cabinets or cabinets with glass doors.
6. All surfaces of exposed shelves.
7. All surfaces exposed to view.

C. Semi-Exposed Portions:
1. Cabinet divisions, shelves, insides of drawers, and any other cabinet members which cannot be seen when door or drawers are closed.

D. Concealed Portions:
1. Cabinet framing that cannot be seen, such as web frame members, sleepers, dust panels, toe strips covered with resilient base.

E. Shelving:
1. Top and bottom surfaces. Face surfaces are the front and rear edges.
a. Ends are the left/right edges as you face the cabinet.
2. The bottom surface material of all Upper Cabinets attached to walls shall be considered a shelf and manufactured as a shelf.

F. Quality Assurance Options:
1. Certified Compliance Program (CCP):
a. The CCP is an established discipline of quality control, for use in conjunction with the NAAWS, which provides a non-biased means of confirming conformance to a project's drawings and specifications.
b. Contractor to provide field inspection by WI Director, additional to CCP requirements.
c. The Woodwork Manufacturer shall have no less than 5 years of production experience, similar to this project, whose qualifications indicate the ability to comply with the requirements of this Section.
d. The Woodwork Manufacturer must have at least one project in the past 5 years where the value of the woodwork was within 20 percent of the cost of woodwork for this Project.
2. Monitored Compliance Program (MCP):
a. The MCP is an established discipline of quality control, for use in conjunction with the NAAWS, which provides a non-biased means of confirming conformance to a project's drawings and specifications,
b. Includes ongoing review/inspections of the project from its start to certification at completion.

c. The Woodwork Manufacturer shall have no less than 5 years of production experience, similar to this project, whose qualifications indicate the ability to comply with the requirements of this Section.

d. The Woodwork Manufacturer must have at least one project in the past 5 years where the value of the woodwork was within 20 percent of the cost of woodwork for this Project.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: It is the intention of this specification section and the drawings to form a guide for a complete and operable system. Any items not specifically noted but necessary for a complete and operable system shall be provided under this section.

1. All shelving must be manufactured according to NAAWS for Schools, Hospitals and Library or Book Shelving. 50 lbs./SF.

1.5 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Product Data.
   a. Submit manufacturer's full color range (including any standard and premium colors) for selection by the Architect.
   b. Submit 2 copies of Manufacturer's current specifications for Modular Casework including all types of cabinets and accessories included in this section to the Architect for approval prior to fabrication.
2. Shop Drawings.
   a. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, seam locations, components, and location and size of each field connection.
   b. Shop Drawing format in accordance with NAAWS Section 1, Submittals and WI's Certified Compliance Program.
      1) The shop drawings for the modular casework shall comply with and bear the WI CERTIFIED COMPLIANCE LABEL.
      2) Each elevation of casework, each laminated plastic top, and each solid surface top shall bear a WI CERTIFIED COMPLIANCE LABEL.
      3) Indicate spacing of all hardware accessories for Architect's review of layout.
      4) On casework and countertop elevations show the location of backing required for attachment within walls.
      5) Before delivery to the jobsite the woodwork supplier shall provide a WI CERTIFIED COMPLIANCE CERTIFICATE indicating the millwork products being supplied and Certifying that these products fully meet the requirements of the Grade or Grades specified.
      6) At completion of installation the woodwork installer shall provide a WI CERTIFIED COMPLIANCE CERTIFICATE indicating the products installed, and Certifying that the installation of these products fully meets the requirements of the Grade or Grades specified.
      7) All fees charged by the Woodwork Institute for their Certified Compliance Program are the responsibility of the millwork manufacturer and/or installer and shall be included in their bid.
3. Samples.
   a. Provide nominal 2" x 3" sample chains of manufacturer's Transparent Wood Finishes to match existing cabinetry.

1) Coordinate with Specification Section -- PAINTING, and submit color samples of manufacturers full color range of transparent finishes for the wood species to match existing.

b. Provide nominal 2" x 3" sample chains of manufacturer's non-premium and premium laminate color selection lines.
1) Submit color samples of Manufacturer's full color and pattern range (including wood grains) of non-premium and premium priced High Pressure Decorative Laminate to the Architect for color selection prior to fabrication.
a) See drawings for high pressure decorative laminate color selection.
2) Submit color samples of high density overlay thermal-fused melamine for color selection by the Architect.
a) Samples shall be equivalent to SELPLY products, from their full color range selection chain of colors.
3) Provide finish color selection samples of Pilaster Standard. Specified colors subject to change.

c. Mock-up as described elsewhere in this section.

4. Quality Assurance/Control Submittals:
a. Certificates:
1) Submit three (3) copies of the following:
a) Before delivery to the jobsite, the modular cabinetwork supplier shall issue a WI CERTIFIED COMPLIANCE CERTIFICATE indicating the modular cabinetwork products and/or fabrication of products to be furnished for this project shall meet fully all the requirements of the grade or grades specified.
b) Upon completion of inspection of installation by WI Inspector, a WI CERTIFIED COMPLIANCE CERTIFICATE shall be furnished for the installation.
2) Submit three (3) copies of a letter on Contractor's Letterhead certifying work provided, meets or exceeds, the requirements of this Section.

b. Labels:
1) Each plastic laminate countertop supplied shall bear the WI CERTIFIED COMPLIANCE LABEL.

1.6 QUALITY ASSURANCE

A. Qualifications:
1. Material Qualifications:
a. Grades as indicated on the drawings in accordance with the specifications, rules and details or casework of the NAAWS Sections 5 "Finishing," 10 "Casework," and 11 "Countertops," unless the drawings and these specifications modify said standards.
1) See Appendix "A" for "Cabinet Design Series" (CDS) Number System used on Modular Casework Schedule.
b. Laminated Plastic Countertops, Splashes, and Wall Paneling in accordance with NAAWS Section 11 "Countertops."
2. Installer Qualifications:
a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
3. Manufacturer/Supplier Qualifications:
a. Firm(s) experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

b. All modular Cabinet Work must be done by a Single Source WI licensed manufacturer and be able to provide a WI Certified Compliance Certificate.
c. Participation in Woodwork Institute Quality Assurance Program:
1) If supplier is WI Member Licensee in good standing:
a) Comply with WI CERTIFIED COMPLIANCE PROGRAM (CCP).
b) Provide WI Director to inspect installation on-site.
2) If supplier is not WI Member Licensee in good standing:
a) Comply with WI MONITORED COMPLIANCE PROGRAM (MCP).

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
a. CBC All hardware for casework shall meet CBC Section 11B-309.4 and 11B-811.4.
b. California ARB ATCM California Air Resource Board's Air Toxics Control Measure for Composite Wood, 17 CCR 93120

C. Mockups:
1. Prior to fabricating or installing Modular Cabinet Work, construct a mockup to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Provide one lower cabinet with drawer, and one upper cabinet, with all examples of hardware for both lower and upper cabinets.
2. Provide mock-up of exposed and interior cabinet surfaces with Pilaster Shelf Standard for review and comment prior to fabrication. Color selection of Pilaster may be subject to change.

D. Meetings:
1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
a. Coordinate the work with all other related work
b. identify potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
c. Review the locations of backing required for casework installation as shown on the casework shop drawings and the Contract Documents.
d. Review the method of attachment of the backing to the wall system as shown on the Contract Documents.
2. Progress: Scheduled by the Contractor during the performance of the work.
a. Review for proper installation of work progress.
b. Identify any installation problems and acceptable corrective measures.
c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
a. WI Inspector, Project Inspector, and the Architect shall inspect and identify any problems that may impede issuance of warranties or guaranties.
b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:

1. Hardware products (not already applied) must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
2. Casework products must be free from scratches, gouges, or any other marring or discoloration.
3. Damaged products will not be accepted.

C. Storage and Protection:
1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units, in compliance with PROJECT CONDITIONS below.
a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.8 PROJECT CONDITIONS

A. Environmental Requirements:
1. Humidity and Temperature: Maintain humidity and temperature in the space to receive products between 45 percent to 65 percent at a temperature of 60 degrees to 90 degrees F. Equilibrium Moisture Content of the wood product conditions shall be maintained between 8 percent and 12 percent. Maintain these requirements for four (4) days minimum prior, during, and following installation in accordance with manufacturer's written recommendations. Inform the Owner of humidity requirements for products installed and maintain until Substantial Completion and the turn-over of the building or facility to the Owner.

1.9 WARRANTY

A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
1. In accordance with manufacturer's written standard warranty:
a. Warranty Period One (1) Year.

C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES
a. Warranty Period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
1. Specified product manufacturers:
a. High Pressure Decorative Laminate: WILSONART.

1) Cabinet Liner Series Type CLS.
b. Solid Surfacing: E.I.DuPONT.
c. Cabinetry Hardware: See Cabinet Hardware Schedule.
d. Countertop Support Brackets RAKKS.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 CABINET MATERIALS

A. Exposed Materials:
1. General:
a. In accordance with NAAWS Section 4 - Sheet Products.
b. Minimize seams.
2. Laminate Systems:
a. Decorative Laminate:
1) Horizontal Surfaces: Post-formed Grade HGP (0.042").
2) Vertical Surfaces: Grade VGP (0.027").
a) Pattern direction: Vertical, unless otherwise noted.
b. Edgebanding:
1) Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors and drawer fronts, 0.5 mm thick elsewhere. Color to match adjacent material.
3. Solid Surface:
a. Decorative synthetic marble of solid (mineral and acrylic filled) Methyl Methacrylate.

B. Semi-Exposed Materials:
1. Cabinet Liner:
a. Complying with requirements of NEMA LD-3, Grade CLS.
2. Edgebanding:
a. Rigid PVC extrusions, through color with satin finish.
1) Typical: 0.5 mm thick.
2) Front edge of shelves and all edges of drawers: 3 mm.

C. Concealed Materials:
1. Medium Density Fiberboard (MDF): ANSI A208.2.
a. Grade 130.
b. Grade 155.
2. Particleboard: ANSI A208.1, Grade M-2.
a. 44-50 lb Industrial Grade core.
b. Thickness Swell max: 5.5 percent.
3. Veneer Core Hardwood Plywood (VCHP):
a. No internal voids.
b. MDF cross bands to limit telegraphing of core grain is acceptable.

D. Fasteners:
1. Per NAAWS.
2. Corrosion resistant fasteners throughout the assembly of modular casework.
3. Confirmat screws.

2.3 FABRICATION

A. General:
1. In accordance with NAAWS Section 10 - Casework, Custom Grade, as amended by the Contract Documents.
2. Interface Style, Frameless: Flush Overlay.
3. Seismic Force Requirements - The types of construction approved by WI that meet CBC Title 24 seismic force requirements are: Lock Joint, Dowled, Dowled / Screwed Construction, Rabbeted Construction, Confirmat Screws, Fully Plowed-in Back, and Backs Screwed on in rabbeted ends, tops, and bottoms. The exact method for seismic force construction is available from WI.
4. Construct openings and backing as required for work done under Division 22 PLUMBING (sinks, plumbing, etc.) and Division 26 ELECTRICAL (outlets, switches, wiring, etc).
   a. Exposed Edges: All exposed edges shall be sealed; including sink cut-outs & bottom edges of front edges.
5. Cabinets ganged together or attached to the wall shall be attached with countersunk screws to prevent binding of shelves when provided later.
6. Any vertical or horizontal plane surface less than four (4) foot wide and twelve (12) foot long shall be faced with one continuous sheet with the intent to minimize the number of seams throughout the work, in compliance with NAAWS Section 8 "Wall Surfacing."
7. Exposed ends, panels, and back panels shall flush out with face of doors and drawer fronts.

B. Cabinets:
1. Cabinet box:
   a. Bottoms and Ends of Cabinets: 3/4-inch particleboard.
   b. Tops of Wall Cabinets and Tall Cabinets: 3/4-inch particleboard.
   c. Backs of Cabinets: Particleboard.
      1) Concealed Backs: 1/4" minimum.
      2) Exposed Backs: 1/2" minimum.
2. Filler Strips:
   a. Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.
3. Shelving System:
   a. Routed 'let-in' Bracket Shelf Support System:
      1) Provide four stainless steel clips for each shelf.
   b. Shelves: Veneer Core Hardwood Plywood.
      1) Span less than 25-inches: 3/4-inch.
      2) Span greater than 25-inches: 1-inch.
      3) Library shelves of any span: 1-inch thick.
4. Doors:
   a. Doors: 11/16 inch core, 3/4 inch thick finished.
      1) Core material: MDF grade 130.
   b. Large doors: 1 inch core, 1-1/16 inches thick finished.
      1) Large doors are more than 48 inches high and more than 24 inches wide.
      2) Core material: MDF grade 155.
   c. Stiles and Rails of Glazed Doors: 3/4 inch thick.
      1) Core material: Particleboard.
   d. Hinges:
      1) Let in 1/8 inch reveals for institutional hinges.
      2) Up to 48" high Doors: 3 hinges unless otherwise indicated on the drawings.
      3) 48" to 80" high Doors: 4 hinges unless otherwise indicated on the drawings.

4) Door higher than 80": 5 hinges unless otherwise indicated on the drawings.

5. Drawers:
   a. Drawer Fronts: 3/4-inch Particleboard.
   b. Drawer Sides and Backs: 1/2-inch Veneer-Core Hardwood Plywood.
      1) Joined using Confirmat Screws in lieu of dowels.
   c. Drawer Bottoms: 1/2-inch Veneer-Core Hardwood Plywood glued and dadoed into front, back, and sides of drawers.
   d. File Drawers / Lateral File Drawers:
      1) Sides: 3/4-inch Veneer-Core Hardwood Plywood.
      2) Bottoms: 5/8 inch Veneer-Core Hardwood Plywood.
      3) Sides and bottoms shall be secured using 2-inch Confirmat screws.
      4) Accessories: COMPX "Timberline" frames.
   e. Security Panels: 1/2-inch Veneer-Core Hardwood Plywood.
      1) Provide Security Panels above and below all locking drawers.
6. All drawers and doors shall be locked, keyed alike in each room and with building masters and grand master.
   a. Each room shall be keyed alike:
      1) Provide 4 keys per lock.
      2) Provide 6 master keys.

C. Countertops:
1. General: In accordance with NAAWS Section 11 -- Countertops, as amended by the Contract Documents.
2. Laminate Countertops:
   a. Standard: In accordance NEMA standard LD-3.
   b. Strength: 3/16 inch maximum deflection with 150 pound load at midspan.
   c. Surface Material: Plastic Laminate.
   d. Backing Material: Cabinet Liner.
   e. Core: 3/4-inch Particleboard.
   f. Front Edge: Self-edge build-up with drip groove edge.
   g. Front Edge: Seamless waterfall with drip groove edge.
   h. Back Splash: 6 inch integral cove splash, unless otherwise indicated on the drawings.
   i. End Splash: 6 inch butt end splash, unless otherwise indicated on the drawings.
   j. Top of Splash: Square Edge.
   k. Exposed Edges: All exposed edges shall be sealed; including sink cut-outs & bottom edges of front edges.
3. Solid Surface:
   a. Solid Surface thickness: 1/2 inch at counter and back splash.
   b. Core: Veneer-Core Plywood - see drawings for thickness required.
   c. Front Edge: Build up with drip groove edge.

D. Fabrications:
1. Solid Surface:
   a. Various locations: Thickness as noted on drawings.
   b. Wall cladding: 1/4 inch thick unless otherwise noted.

E. Hardware:
1. See schedule at the end of this section for typical cabinet hardware.
2. Hardware shall be furnished and installed as required to provide a complete casework installation for overlay construction, unless noted otherwise.
3. Provide metal strike at locks.

4. Finish: BHMA 626 (26D), unless otherwise noted.

F. Countertop Supports
1. Steel Support Angle and Base Plate:
a. Single-piece construction: All welded ground smooth, flush and level.
b. Finish: Galvanized.
c. Angle material to be A36 (Fy=36ksi).
d. Plate material to be A36 (Fy=36ksi).
e. All welding to conform to NAAWS and shall be done by certified welders.
f. All work shall conform to the latest edition of the American Institute of Steel Construction.
2. RAKKS (EH Series Counter Support Brackets):
a. EH-1818 for counter depths up to 25"; suitable for surface mounted conditions.
b. EH-1824 for counter depths up to 30"; suitable for surface mounted conditions.
c. EH-1818FM for counter depths up to 25"; suitable for flush mounted conditions.
3. EH-1824FM for counter depths up to 30"; suitable for flush mounted conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual, which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
1. Coordinate work under this specification section with work specified under other specification sections to ensure proper and adequate interface of work specified under this specification section.

B. Protection:
1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

C. Surface preparation:
1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

3.3 INSTALLATION

A. General:

1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
    a. Provide experienced, factory trained craftspeople under manufacturers direct supervision.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. The entire installation shall present a first class, workmanlike appearance, without open joints, tool marks or other blemishes, and subject to the Architect's approval.
5. Edges of cutouts, subject to excessive moisture, shall be sealed with a color-toned (for verification), water-resistant sealer before trim or sink rims are installed.

B. Layout:
1. Set plumb, level, and to true lines as shown on the drawings.
2. Filler panels and scribe strips or moldings, as required, shall be properly scribed to adjacent work and securely attached to cabinets as indicated on the drawings.

C. Anchorage:
1. The backs of the cabinets shall be secured to the wall backing.
2. Refer to the Drawings for the backing and anchorage details.

D. Cabinet Bases:
1. Toe Kick: Cabinet base shall be set back from the face of the cabinet 3-inches, or as indicated
2. Cabinet sides: Cabinet shall be set 3/8-inch back from the face of the cabinet.

3.4 FIELD QUALITY CONTROL

A. Inspection:
1. Schedule WI inspection with a minimum of 7 days notice of planned installation.
2. Schedule inspections and notify the Architect, Owner's Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
3. No work shall be without the inspections required by Regulatory Requirements.

3.5 ADJUSTING

A. Test and adjust carpentry hardware. Replace damaged or malfunctioning controls and equipment.

3.6 CLEANING

A. Clean in accordance with Specification - PROJECT CLOSEOUT.
1. Clean any soiled surfaces immediately.
2. In accordance with manufacturer's written instructions and recommendations.
3. Finish shall be clean and ready for the application of any additional finishes.

3.7 PROTECTION

A. Protection from traffic:
1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

3.8 SCHEDULES

A. Standard Cabinetry Hardware specified, or approved equivalent:
1. Hinges: Institutional Hinges for Overlay doors, 2-3/4" five knuckle with hospital tips and 2-5/8" extended side panel wing:
   a. ROCKFORD PROCESS:
      1) #374 for 3/4" side panel x 3/4" thicknesses.
      2) #376 for 3/4" side panel x 13/16" thicknesses.
2. Pulls (Steel Wire "U" Shaped - 4" centers, 1-1/4" Projection from face of drawer or door):
      a) JAMISON: SWP4-26D.
3. Locks (Hinged Doors and Drawers for Overlay Construction):
   a. COMP X NATIONAL: #C8053.
   b. Approved equivalent manufacturer:
      1) OLYMPUS LOCK, INC. #DCN as required.
   c. Provide compatible strike.
   d. OLYMPUS LOCK, INC. #DCN as required.
   e. Approved equivalent manufacturer:
      1) COMP X NATIONAL: #C8053.
   f. Provide compatible strike.
4. Drawer Slides up to 24 inches Wide:
   a. Pencil Drawers:
      1) 65 lb capacity, full extension, lever disconnect:
         a) ACCURIDE 2632.
      2) Approved equivalent manufacturer:
         a) KNAPE AND VOGT: 4400.
   b. General Purpose Drawers:
      1) 100 lb capacity, full extension, rail mount disconnect:
         a) ACCURIDE 7432.
      2) Approved equivalent manufacturer:
         a) KNAPE AND VOGT: 8400.
   c. File Drawers:
      1) 150 lb capacity, full extension, rail mount disconnect:
         a) ACCURIDE 4032.
      2) Approved equivalent manufacturer:
         a) KNAPE AND VOGT: 8500.
5. Drawer Slides over 24 inches Wide:
   a. Pencil Drawers:
      1) 100 lb capacity, full extension, push latch disconnect:
         a) ACCURIDE 3732.
      2) Approved equivalent manufacturer:
         a) KNAPE AND VOGT: 8400.
   b. General Purpose Drawers:
      1) 150 lb capacity, full extension, rail mount disconnect:
         a) ACCURIDE 3641.
      2) Approved equivalent manufacturer:
         a) KNAPE AND VOGT: 8500.
   c. File Drawers:
      1) 200 lb capacity, full extension, rail mount disconnect:
         a) ACCURIDE 3642.
      2) Approved equivalent manufacturer:
         a) KNAPE AND VOGT: 8800.
6. File Frames for File Drawers & Lateral File Drawers.
   a. COMPX TIMBERLINE File Frame System.

7. Adjustable Shelf Pilaster Standard and Shelf Supports:
   a. Pilaster Standard shall be KNAPE & VOGT #255, 19-gage x 5/8" wide x 3/16" high.
      1) #255-WH (Epoxy-Coated White) at interior cabinet surface locations.
      2) #255-BRN (Brown) at exposed cabinet surface locations.
   b. Shelf Supports shall be KNAPE & VOGT #239 ZC (Zinc Coated).
8. Magnetic Catcher:
   a. AMEROCK: #CM9783-AL.
   b. Approved equivalent manufacturer:
      1) KNAPE AND VOGT: #918-AL.
9. Joint Closure:
   a. PEMKO: #313AN.
10. Coat Hooks (Cast aluminum wardrobe hook):
    a. IVES: #E IVSP581A3.
11. Exposed Fasteners: When exposed fasteners are used, provide zinc chromate coated oval head, self-tapping phillips screws with grommet finishing washers, same finish as screws.
12. Cabinet Catch (only when indicated on the drawings)
    a. STANLEY #CD34.
13. Label Plate:
    a. HAFELE #168.02.761.
14. Grommets, Cable Managers and Cabinet Vents:
    a. Provide grommets, cable managers and cabinet vents in various sizes, finishes and shapes, as indicated on the drawings and as otherwise required for a complete installation.
    b. Provide type S/S-3 Grommet for all conditions not noted. Grommets & Air Vents by DOUG MOCKETT & COMPANY, INC., or approved equivalent.
    c. A partial listing is provided below (for other listings, see the drawings):
       1) Wire Manager: #WN-2A.
15. Miscellaneous Hardware Items:
    a. HAFELE:
       1) Bow Handles: #102.49.402.
       2) Metal Label Frames: E168.02.789 (nickel-plated).
       3) Miscellaneous: Dished Sleeves, screws, washers, nuts, threaded pins, screw-in sleeves, shelf supports with locking screws, connecting fittings, & capped bolts.

END OF SECTION

SECTION 07 14 16 – FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all fluid applied waterproofing system materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this Section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 03 30 00 CAST-IN-PLACE CONCRETE
   4. 04 21 00 BRICK MASONRY UNITS
   5. 04 21 30 THIN BRICK VENEER
   6. 04 22 00 CONCRETE MASONRY UNITS
   7. 05 30 00 METAL DECK
   8. 07 60 00 SHEET METAL
   9. 07 92 00 SEALANTS
   10. 31 20 00 EARTHWORK
   11. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   12. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product Data: Materials list, manufacturer's catalog sheets and other product information.
   2. Quality Assurance/Control Submittals:
      a. Manufacturer's Written Instructions:
   3. Closeout Submittals in accordance with Specification Sections in Division One:
      a. Warranty in accordance with Specification Section - WARRANTIES.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Material Qualifications:
      a. All products of the membrane system shall meet the requirements of the Air Quality Control Standards in effect at the Project Site and at the time of application.
   2. Installer Qualifications:
      a. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
      b. Applicator shall have a copy of this Section of the Specifications and a copy of the Manufacturer's approved Specifications on the Work at all times.
   3. Manufacturer/Supplier Qualifications:
      a. Manufacturer's Representative shall be present at beginning of Work and shall inspect Work periodically during application.

B. In accordance with Specification Section - REGULATORY REQUIREMENTS.

C. Meetings:
   1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
      a. Inspect the substrates with the intent to coordinate the Work related to the membrane and to insure a watertight design.

b. Coordinate the work with all other related work.
c. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.

2. Progress: Scheduled by the Contractor during the performance of the work.
   a. Review for proper installation of work progress.
   b. Identify any installation problems and acceptable corrective measures.
   c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
   a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
   b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage. Damaged products will not be accepted at final inspection.
B. Acceptance at Site:
   1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
C. Storage and Protection:
   1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
      a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.5 PROJECT CONDITIONS

A. Environmental Requirements:
   1. No application of fluid applied urethane membrane or flashing shall commence or proceed during inclement weather, or the threat of imminent precipitation.
   2. All surfaces to receive the system shall be thoroughly dry and free of dew or frost.
   3. Application temperatures are not limited except that materials shall be stored until time of mixing at temperatures above 60 degrees Fahrenheit to maintain a consistency suitable for mixing.
B. Existing Conditions:
   1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
   2. Field Measurements: Take and be responsible for field measurements as required. Prior to performing work report any significant differences between field dimensions and Drawings to Architect.
C. Inspection Walls and Flashing Surfaces:
   1. The Contractor shall examine all surfaces designated to receive the system and unacceptable surfaces shall be reported to the Architect.
   2. Surfaces shall be slightly textured, but free of all voids, projections, fins, honey combing, and rock pockets.
   3. Surfaces shall be free of contaminants such as, but not limited to oil, grease, paint, scale, cement laitances, curing compounds and similar materials.

1.6 WARRANTY

A. Contractor's General Warranty: In accordance with Specification Section - WARRANTIES.
B. Manufacturer's Warranty, in accordance with manufacturer's written standard warranty:

1. Warranty Period Five (5) Years
2. For fluid applied membrane waterproofing system, including labor and materials.

C. Installer's Warranty, in accordance with Specification Section – WARRANTIES:
1. Warranty Period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - PRODUCT SUBSTITUTIONS.

2.2 MATERIALS

A. Provide waterproofing materials recommended by manufacturer to be fully compatible with and able to develop bond to substrate under conditions of service and application required, as demonstrated by waterproofing manufacturer based on testing and field experience:
1. Compound waterproofing for vertical or horizontal application and slope of substrate indicated. Provide waterproofing with not less than 100 percent solids.
2. Specified product manufacturer:

2.3 FLUID-APPLIED WATERPROOFING

A. Two-component, solvent free polyurethane complying with performance and physical requirements of ASTM C 836 "Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course," and with manufacturer's printed physical requirements as certified by a qualified independent testing agency.
1. GACO WESTERN #LM-60.
2. SIKA CORPORATION "SikaFlex 1A."
3. Specified product physical requirements:

Property	**ASTM TEST METHOD**	**VALUE**
Tensile	D412	175 psi
Elongation	D412	300 percent
Solids (by Volume)	-	100 percent
Water Vapor Permeability	E96	0.012 perm in.
Water absorption	D 47 21 days R.T.	1 percent maximum
Low Temperature	D746	Pass @ -50 degrees F.
Hardness, Shore A	D 2240	30
Tear resistance	D 524 Die C	30 pli

~~2.4 SHEET MEMBRANE WATERPROOFING~~

~~A. Pre-applied Integrally Bonded Waterproofing Membrane: "Preprufe 300R" Membrane (or "Preprufe 300LT" Membrane for application temperatures between 25 degrees F and 60 degrees F) by GRACE CONSTRUCTION PRODUCTS, a 1.2 mm nominal thickness composite sheet membrane comprising 0.8 mm of high density polyethylene film, and layers of specialty formulated synthetic adhesive layers. The membrane shall form an integral and permanent~~

bond to poured concrete to prevent water migration at the interface of the membrane and structural concrete.

1. Specified product physical requirements:

Property	ASTM TEST METHOD	VALUE
Thickness	D 3767 Method A	1.2 mm nominal
Lateral Water Migration Resistance	D 5385 Modified [1]	Pass at 71 m of hydrostatic head pressure
Low Temperature Flexibility	D 1970	Unaffected at -20 degrees F
Elongation	D 412 Modified [2]	500 percent
Crack Cycling at -9.4 degrees F, 100 Cycles	C 836	Unaffected, Pass
Tensile Strength, Film	D 412	27.6 MPa (4,000 lbs/in^2)
Peel Adhesion to Concrete	D 903 Modified [3]	880 N/m (5.0 lbs/in)
Lap Adhesion	D 1876 Modified [4]	880 N/m (5.0 lbs/in)
Resistance to Hydrostatic Head	D 5385 Modified [5]	71 m (231 ft)
Puncture Resistance	E 154	990 N (221 lbs)
Permeance	E 96 Method B	0.6 ng/Pa x s x m^2 (0.01 perms)
Water Absorption	D 570	0.5 percent

2. Footnotes:

a. Lateral water migration resistance is tested by casting concrete against membrane with a hole and subjecting the membrane to hydrostatic head pressure with water. The test measures the resistance of lateral water migration between the concrete and the blind side waterproofing membrane. A hydrostatic head pressure of 71 m (231 ft) of water is the limit of the apparatus.

b. Elongation of membrane is run at a rate of 50 mm (2 in) per minute.

c. Concrete is cast against the protective coating surface of the membrane and allowed to cure (7 days minimum). Peel adhesion of membrane to concrete is measured at a rate of 50 mm (2 in) per minute at room temperature.

d. The test is conducted 15 minutes after the lap is formed as per manufacturer's instructions and run at a rate of 50 mm (2 in) per minute.

e. Hydrostatic Head tests are performed by casting concrete against the membrane with a lap. Before the concrete sets a 3 mm (0.125 in) spacer is inserted perpendicular to the membrane to create a gap. The cured block is placed in a chamber where water is introduced to the membrane surface up to a head of 71 m (231 ft) of water which is the limit of the apparatus.

2.52.4 ACCESSORIES

A. Flashing Materials:
   1. Flashing: 60 mil neoprene sheet, uncured, non-staining.
   2. Flashing Adhesive: Manufacturer's written recommended bonding & splicing adhesive.
   3. Primer For Metal Surfaces: Manufacturer's written recommended primer compatible with main waterproofing membrane materials, metal type to be bonded to, and air quality standards in the location where the project is located.
   4. Release Tape: 1" masking tape, unless otherwise noted.
   5. Urethane Sealant: As specified.

B. Primer Sealer System:
   1. For Lightweight Concrete Substrate:

~~a. Manufacturer's written recommended primer/sealer system compatible with main waterproofing membrane material and air quality standards in the location where the project is located.~~

~~2.~~1. For Concrete Substrate:

a. Manufacturer's written recommended primer/sealer system compatible with main waterproofing membrane material and air quality standards in the location where the project is located.

C. Protection Boards:

1. Horizontal:

a. W.R. MEADOWS "Sealtight Protection Course – PC-2."

~~b. Between Concrete Slabs: 1/8" thick x 4' x 8' panel.~~

~~1) Standard Duty multi-ply, semi-rigid board composed of mineral-fortified asphaltic core formed between a liner of asphalt-saturated felt and a glass mat liner which is weather-coated and covered with a polyethylene anti-stick sheet.~~

~~2) Backfill protection board only.~~

2. Vertical Drainage Composite:

a. Vertical Protection Boards:

~~1) Drainage Composite: JDR ENTERPRISES, INC. – "J-Drain 302."~~

2) Asphalt Impregnated: W.R. MEADOWS - "Sealtight Protection Course – PC-3"

b. Core:

1)	Color	Black.
2)	Compressive strength (ASTM D 1621)	30000 psf.
3)	Thickness (ASTM D 1777)	0.22 inch.
4)	Flow (ASTM D 4716)	5.5 gpm/ft. width.

c. Fabric:

1)	Flow (ASTM D 4491)	205 gpm/ft2.
2)	Mullen Burst (ASTM D 3786)	285 psi.
3)	Puncture (ASTM D 4833)	80 lbs.
4)	U.V. Resistance (ASTM D 4355)	Fully Stabilized.
5)	Grab Tensile (ASTM D 4632)	120 lbs.

3. Vertical Asphalt Impregnated (No drainage requirement) - 1/2" thick x 4' x 8' panel.

a. Asphalt Impregnated protection board

b. Backfill protection board only.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual that affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination: Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection: Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

C. Surface Preparation:
   1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
   2. Clean substrates of substances that could impair bond of materials specified within this section.
   3. All control joints and non-moving cracks shall be treated prior to the application of the fluid applied membrane, over the main field of the deck.
      a. All control joints and non-moving cracks shall be filled with fluid applied membrane and strip coated with 60 mils of fluid applied membrane extending for 3" on each side of such joints on cracks.
      b. When coating the main field of the deck, the fluid applied membrane shall extend over these cracks and joints to obtain a total membrane thickness of 120 mils.
   4. All moving cracks shall be treated prior to the application of the fluid applied membrane, over the main field of the deck.
      a. Remove all loose chips of substrate along the edge of the crack.
      b. Install urethane sealant in the crack and strike flush with the concrete surface.
      c. All moving cracks shall be covered with 3" masking tape, centered over the crack and strip coated with 60 mils of fluid applied membrane extending 3 inches on each side of the tape.
      d. When the main field of the deck is coated with fluid applied membrane, it shall extend over these cracks to obtain a total buildup at 120 mils over such cracks.

D. Priming and sealing:
   1. Primer as recommended by manufacturer, shall be roller applied at a rate recommended by the manufacturer for the system installed, and in accordance with the manufacturer's warranty requirements.
      a. If the primer is not installed over the entire substrate surface in one day, do not overlap prior day's work when applying the primer.
      b. It would be preferable to leave a narrow uncoated area than to overlap subsequent days of application of the primer.
      c. Drying time for primer shall be in accordance with the manufacturer's written recommended drying times for degrees of temperature range shown on the manufacturer's written instructions.
   2. Structural Grade Concrete:
      a. When the porosity of the concrete is such that entrapped air may cause blisters or pinholes in the coating, the concrete surface shall be sealed with primer as recommended by manufacturer.
      b. The seal coat shall be applied by roller only.
      c. The seal coat shall be allowed to cure until such time that workmen applying the system can walk on it without damage to the coating.
      d. Seal coat shall not be left exposed without top coat for more than 48 hours. Should a longer time elapse, the seal coat shall be wiped with primer as recommended by manufacturer.

3.3 INSTALLATION OF WATERPROOFING

A. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.

B. Fluid applied membrane shall be applied in two coats at the rate of 51 square feet per gallon per coat, resulting in an average dry mil thickness of 30 mils for each coat, sixty mils average total thickness.

C. Vertical surfaces: manufacturers recommended membrane for vertical surfaces.

D. Horizontal surfaces: manufacturers recommended membrane for horizontal surfaces.

E. Fluid applied membrane shall overlap all sheet membranes a minimum of 3 inches.
F. Coat sheet membranes with recommended adhesive in areas where fluid applied membrane overlap.
G. Newly applied membrane shall overlap cured membrane a minimum of 3 inches.
H. If cured material has been in place for 48 hours or more, wipe with manufacturers recommended reactivating agent before overlapping with freshly applied material.
I. Perform water testing prior to installation of protection board.

3.4 INSTALLATION OF PROTECTION BOARD

A. Protection board layout lines shall be straight and true.
B. All fluid applied membrane installed below grade shall be covered with protection panel system.
   1. The protection panel provides drainage against the wall and protect the waterproof membrane during backfill operations.
C. Attach directly to waterproof membrane using manufacturer's written recommended adhesive, and in accordance with the manufacturer's written requirements.
   1. Press panel into place over cured waterproofing membrane.
   2. Press panel firmly on entire surface to ensure good adhesive bond.
   3. Stagger vertical joints and butt panels tightly together.
   4. Field cutting: use a hand saw, hot wire or hot knife.
   5. Cover weep holes with galvanized metal or stainless steel wire screen to support and retain panel.
   6. Connect to ~~perimeter~~ drain pipe with gravel in accordance with manufacturer's written recommendations.
   7. Cover gravel with geotextile fabric in accordance with manufacturer recommendations.

3.5 FIELD QUALITY CONTROL

A. Water Testing:
   1. All horizontal areas should be water tested prior to the installation of a wear course.
   2. No area shall be water tested within 48 hours after application.
   3. Water testing shall include flooding of the entire deck either by section or entirely for a minimum period of 24 hours.
   4. Any area where leaks occur shall be drained, thoroughly dried, repaired, and then retested.
   5. Installation of the wear course shall not start until such time as the membrane is leak-free and has been accepted by the owner or his representative.
B. Inspection:
   1. Schedule inspections and notify the Architect, Owner's Inspector and any regulatory agencies of the time at least 48 hours prior to the inspection.

3.6 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
B. Clean any soiled surfaces immediately.
C. Finish shall be clean and ready for the application of any additional finishes.
D. In accordance with manufacturer's written instructions and recommendations.

3.7 PROTECTION

A. Protection from Weather:
   1. Protect newly installed work from freezing for 24 hours after erection, installation or application.
   2. Until such time as the membrane has been covered with backfill or protective wear course, the area shall be kept free of all traffic and other trades.
B. Protection from Traffic:

1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

END OF SECTION

SECTION 07 18 50 – VAPOR-ALKALINITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment, testing and services necessary to:
      a. Completely install all Vapor-Alkalinity Control 100 percent solids epoxy membrane materials, accessories and other related items necessary to control for water vapor and alkalinity in existing or new concrete slabs for the Project.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS (Including BID FORM)
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 03 30 00 CAST-IN-PLACE CONCRETE
   4. 09 30 00 TILE
   5. 09 65 19 RESILIENT TILE
   6. 09 67 23 RESINOUS FLOORING
   7. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

C. Cost of Work:
   1. The entire cost for providing the vapor-alkalinity control specified under this Section shall be listed on the BID FORM as a Line Item and included as a part of the Base Bid. Refer to the BID FORM.
   2. If it is determined by way of testing, and it is agreed to by the Owner, Architect, Contractor, and the Flooring Installer, that the work of this Section is not required, then this Work (or a portion of this Work agreed to by the Owner, Architect and the Contractor) for the Installation of the Vapor-Alkalinity Control Membrane System will be deleted from the Project by the way of a Change Order, and the Contract Sum shall be reduced accordingly.

1.2 REFERENCES

A. Standards:
   1. In accordance with the following standards:
      a. ACI American Concrete Institute
         1) ACI Committee Report 201 "Guide to Durable Concrete"
      b. ASTM American Society for Testing Materials International

1.3 DEFINITIONS

A. Membrane System: "Water Vapor-Alkalinity Membrane System."
B. New Concrete Slab: Any concrete slab poured after the signing of the Contract for this Project, regardless of the duration of the construction period.
C. Existing Concrete Slabs: Any slabs existing (or poured) prior to this Project.
D. pH: Alkalinity.
E. RH: Relative Humidity.
F. MVER: Moisture Vapor Emission Rate.
G. Hg: Mercury.

1.4 SYSTEM DESCRIPTION

A. The Moisture Vapor Control System shall be specifically formulated and marketed for concrete floor slab moisture vapor and pH control.

B. Membrane System Performance Requirements: It is the intention of this section to form a guide for a complete membrane system. Any items not specifically noted but necessary for a complete membrane system shall be provided under this section. Membrane System shall comply with the following:

1. Shall control alkalinity for a long term maximum resistance of pH 14 per pH Testing of ASTM F 710 "Preparing Concrete Floors to Receive Resilient Flooring."
2. Shall control vapor transmission up to and including 100 percent readings per RH Testing of ASTM F 2170 "Determining Relative Humidity in Concrete Floor Slabs Using *in situ* Probes".
3. Perm Rate Results (net perms - grains /hr/sq.ft. in 1 inch of Hg) of the membrane system shall not exceed:
    a. New Concrete Slabs: 0.09 grains/sq. ft./hour in 1 inch of Hg or less per ASTM E 96 "Water Vapor Transmission of Materials" per the Water Method for new concrete slabs.
    b. Existing Concrete Slabs: 0.05 grains/sq. ft./hour in 1 inch of Hg or less per ASTM E 96 "Water Vapor Transmission of Materials" per the Water Method for renovation work on existing slabs.
4. Compatible with all types of floor covering products and systems specified for this project.
5. Independently tested with certified results.
6. Contain no silicate or water/alkaline soluble compounds.
7. Capable of the following in an environment of constant water vapor and water exposure:
    a. System shall be capable of curing well when water saturation of the surface underneath coatings can begin within a short period of time depending on the amount of osmotic water/moisture permeating through the concrete.
    b. Rapid adhesion to the substrate without jeopardizing the long term bonding performance.
8. Sufficient density to avoid water vapor damage to other adhered systems.
9. Resistant to most commonly encountered acids/solvents in case of topical exposure (spills).

1.5 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Product Data:
    a. Manufacturer's Data for each type of product specified.
2. Quality Assurance/Control:
    a. Test Reports:
        1) Independent Testing Laboratory test results for RH (relative humidity) in concrete.
        2) Independent Testing Laboratory test results for pH on concrete.
        3) Contractor test results for Perm Rating of the Membrane System that the net perms test results shall be submitted with verification that lab applied the manufacturer's product to the test samples.
    b. Manufacturer's Instructions:
        1) Written installation instructions.
    c. Manufacturer's Field Reports:
        1) Written field report detailing installation observations.

2) Final field report after curing indicating installation was performed properly.

d. Qualification Statements
1) Manufacturer's Membrane System Performance requirement letter.
2) List of Previous Projects.
3) Manufacturer's Installer Certification.
4) Manufacturer's Duration of Experience.

3. Closeout Submittals:
a. In accordance with Specification Section – PROJECT CLOSEOUT.
b. In accordance with this specification and with Specification Section – WARRANTIES.

1.6 QUALITY ASSURANCE

A. Qualifications:
1. Material Qualifications:
a. All items shall be within the Membrane System Performance Requirements specified earlier within this specification section.
b. Provide list of at least three (3) projects available for inspection employing same vapor-alkalinity control system(s) within the last ten (10) years, within the same climate zone.
2. Installer Qualifications:
a. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
3. Manufacturer's Qualifications:
a. Firm regularly engaged in the business and manufacture of vapor emission and alkalinity control installations of similar size and complexity with the system proposed for use, and have had experience for at least ten (10) years of manufacturing water-vapor reduction systems with the product submitted.

B. In accordance with Specification Section - REGULATORY REQUIREMENTS.

C. Mock-Up:
1. Install the Moisture Control System in a minimum 100 sq. ft. mock-up area, using the same methods, laborers and equipment that will be used for the entire installation. Test tensile bond strength of the moisture mitigation system to the concrete substrate following ASTM Test Method D 7234. The results shall be equal to or greater than 200 psi with failure in the concrete before proceeding with installation of the moisture control system.

D. Meetings:
1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
a. Coordinate the work with other work being performed.
b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
c. Review delivery, storage, and handling procedures.
d. Review project conditions.
e. Review condition of concrete slabs on grade.
2. Progress: Scheduled by the Contractor during the performance of the work.
a. Review for proper installation of work progress.
b. Identify any installation problems and acceptable corrective measures.
c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.

a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
b. Maintaining installed work until the Notice of Substantial Completion has been executed.

1.7 DELIVERY, STORAGE AND HANDLING

A. Acceptance at Site:
1. Products must be in manufacturer's original unopened containers with labels indicating brand name and product name.
2. Damaged products will not be accepted.

B. Storage and protection:
1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units, in a locked, clean and neat, well ventilated area.
a. Cover material with protective water proof covering providing for adequate air circulation and ventilation.
b. Empty containers shall not be removed from the site, unless approved by the Architect.

1.8 PROJECT CONDITIONS

A. Environmental requirements:
1. Temperature:
a. Maintain ambient temperature in all spaces to receive independent testing and membrane system installation between sixty-five (65) degrees Fahrenheit and seventy-eight (78) degrees Fahrenheit for seven (7) days prior, during, and after installation.
b. Inform the Owner of ambient temperature in space to receive independent testing and membrane system installation and maintain until Substantial Completion and turn-over of the building or facility to the Owner.
2. Ventilation:
a. During membrane system installation provide continuous ventilation and indirect air movement at all times during application and curing process.

B. Existing conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Concrete surfaces shall have cured for not less than twenty-eight (28) days before independent testing.
3. Not less than seven (7) days shall have passed since surfaces were last wet.

1.9 WARRANTY

A. Contractor's General Warranty:
1. In accordance with specification section - WARRANTIES

B. Manufacturer's Warranty:
1. In accordance with manufacturer’s written standard warranty.

a. Manufacturer's warranty shall cover against water vapor transmission or out of range levels of alkalinity failure through concrete slabs and includes all labor and material costs for replacement of all products installed over the membrane system.
b. Warranty period Fifteen (15) Years.

C. Installer's Warranty:
1. In accordance with the terms of Specification Section – WARRANTIES:
a. Warranty period Five (5) Years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
1. Membrane System for New Concrete Slabs - Specified product manufacturer:
a. KOESTER AMERICAN CORP. "VAP I 2000 SYSTEM"
b. Approved equivalent manufacturers:
1) ALLIED CONSTRUCTION TECHNOLOGY 2170.
2) MAPEI "Planiseal VS."
2. Membrane System for Existing Concrete slabs - Specified product manufacturer:
a. KOESTER AMERICAN CORP. "VAP I 2000FS SYSTEM"
b. Approved equivalent manufacturers:
1) ALLIED CONSTRUCTION TECHNOLOGY 2170 Fast Setting Product.
2) MAPEI "Planiseal VS" Fast Setting Product.
3. Core Testing Repair Product:
a. CTS CEMENT "RAPID SET CEMENT"

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. General:
1. Membrane System shall be the product of one manufacturer.

B. Membrane System for New Concrete Slab Substrates: One (1) Coat, epoxy 100 percent solids system, containing specifically formulated chemicals and resins complying with the Performance Requirements specified. No silicate or water based formulations are allowed.
1. Pot Life12 minutes.
2. Cure-Time 12 hours.
3. Solid Content 100 percent.
4. VOC, mixed Less than 10 g/L.
5. Flash Point Greater than 200 degrees F.
6. Storage Between 50 degrees F - 90 degrees F.
7. Shelf Life 1 Year minimum in original sealed container.

C. Membrane System for Existing Concrete Slab Substrates: One (1) Coat, epoxy 100 percent solids fast setting system, containing specifically formulated chemicals and resins complying with the Performance Requirements specified. No silicate or water based formulations are allowed.
   1. Pot Life12 minutes.
   2. Cure-Time 4 hours.
   3. Solid Content 100 percent.
   4. VOC, mixed Less than 10 g/L.
   5. Flash Point Greater than 200 degrees F.
   6. Storage Between 50 degrees F - 90 degrees F.
   7. Shelf Life 1 Year minimum in original sealed container.

2.3 ACCESSORIES

A. Bonding Material (if required): Provide membrane manufacturer's written recommended bonding emulsion materials compatible with the membrane system.

B. Crack and Joint Filler:
   1. Provide membrane system manufacturer's written recommended crack and joint materials compatible with the membrane system.

2.4 MIXES

A. Vapor-Alkalinity Control Membrane System:
   1. Use clean containers.
   2. Mix thoroughly as per manufacturer's written requirements to obtain a homogeneous mixture.
      a. Use a low speed motor less than 400 rpm and a two bladed "jiffy mixing blade" only. DO NOT AERATE! Mix ratios are measured by volume.
      b. Specified membrane system shall have its components mixed at a ratio of 2.4:1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
   1. Preparation shall not begin until the Owner, Architect, and Contractor have reviewed independent testing laboratory results of Alkalinity and Relative Humidity testing and have informed the membrane system manufacturer and installer of areas where the membrane system is to be installed.
   2. Prior to the execution (preparation) of the work under this specification section, the Owner's representative shall inspect the installed work executed under other sections of this Project Manual that affect the execution of work under this specification section.
      a. Membrane System Installer to investigate and inform the membrane system manufacturer if Alkali-Silica Reaction is present, and/or oil contamination, concrete additives (using chlorides), or any other soluble compounds that can contaminate surfaces have been used in any concrete mix, or is present in the existing concrete substrate.
   3. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.

4. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:
   1. Protect all adjacent surfaces from drips, spray, air pollution of the surrounding environment, and other damage from work under this specification section.

C. Surface preparation:
   1. Comply with ASTM F 3010 "Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings."
   2. After the Testing Laboratory removal of all RH probes, fill all RH Test holes with core repair product in accordance with membrane manufacturer's written recommendations, and allow curing before any other cleaning occurs.
   3. Clean all surfaces to receive membrane system.
   4. "Shotblast" all floors and clean surfaces with a dust contained vacuum to remove all residue off the substrate to a minimum CSP (Concrete Surface Profile) of 3. Shotblast existing areas to a minimum of CSP 4. Systems introducing water or acids to the floor systems (such as "Hydrablasting" or "Acid Etching") are NOT ALLOWED.
      a. Grinding floor areas is only allowed when floor areas are inaccessible by "Shotblasting".
         1) Grind to a CSP as recommended in writing by the membrane system manufacturer, but in no cases less than 3.
            a) Existing slabs shall be no less than 4.
         2) Where surface profiles require (because of silicate or other bond breaker film applications), grind to a higher level of CSP, as required in writing by the membrane system manufacturer for removal of film items not compatible with the system membrane.
      b. Protect electrical or mechanical equipment items in place from dust and particulate residue that could impede their proper operation.
      c. Remove ALL defective materials and foreign matter such as dust, adhesives, leveling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, "shotblast" bb's, etc.
      d. Remove, after "shotblasting," leaving no reinforcing fibers (if any) left on the concrete surfaces.
         1) Reinforcing fibers must be burned off, scraped and vacuumed.
   5. Repair all cracks, expansion joint, control joints, and open surface honeycombs and fill in accordance with crack and joint filler manufacturer's written recommendations.
      a. Mix with silica sand for large cracks or voids.
   6. Provide an uncontaminated, absorptive, sound surface.

3.3 APPLICATION

A. General:
   1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.

2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Verify that required repairs and fills are complete, cured, and dry before application.

B. Assistance:
1. Application shall be in direct consultation and review of manufacturer’s representative.

C. System Application:
1. The coverage rate for the provided system shall be based on the surface texture and porosity of the substrates as well as the measured level of moisture from the examination of the substrates after surface preparation, and in accordance with manufacturer's written instructions. Approximate minimum coverage of the specified membrane system relative to existing levels of moisture vapor after surface preparation are as follows:
   a. New concrete slabs 150 sq. ft. / gal.
   b. Existing concrete slabs 130 sq. ft. / gal.
   c. Apply one coat of the specified system at the written recommended rates (see above) using a squeegee and or a 3/8 inch nap roller leaving NO areas untreated.
   d. Allow the substrate to cure a minimum of:
      1) New concrete slabs: 12 hours before installing underlayment or flooring system.
      2) Existing concrete slabs: 4 hours before installing underlayment or flooring system.

3.4 FIELD QUALITY CONTROL

A. Site Tests:
1. Prior to the execution (preparation) of the work of this specification section, the Project Inspector will arrange with the Independent Testing Laboratory to perform the following tests:
   a. Alkalinity Testing per ASTM F 710 "Preparing Concrete Floors to Receive Resilient Flooring."
   b. Relative Humidity Testing per ASTM F 2170 "Determining Relative Humidity in Concrete Floor Slabs Using *in situ* Probes."
2. Test only concrete slabs scheduled to receive floor coverings.
3. Test only when concrete floor slabs have cured a minimum of 28 days.
4. Test only when the concrete slabs have been acclimated to final environmental conditions as specified in the Article PROJECT CONDITIONS within this Specification Section.

B. Inspection:
1. Schedule inspections and notify the Architect, Project Inspector, and any other regulatory agencies of the time at least 48 hours prior to the inspection.
2. No work shall proceed without the inspections of the Project Inspector.

C. Manufacturer's Field Services:
1. Membrane System Manufacturer shall field verify and report on observations of system application per manufacturer's recommendations during installation.
2. Membrane System Manufacturer shall issue a Final Field Report, after curing, indicating installation was completed per manufacturer's recommendations.

3.5 CLEANING

A. Cleaning:
1. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
2. Clean any soiled surfaces immediately.

3. Remove all debris resulting from specified system installation from project area.
4. Finish shall be clean and ready for the application of any additional finishes.
5. Clean all tools and equipment as recommended in writing by the manufacturer.

3.6 PROTECTION

A. Protection:

1. Protect membrane system during specified cure periods from any kind of traffic, topical water, and contaminants.

END OF SECTION

SECTION 07 21 00 – INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

B. Provide all material, labor, equipment and services necessary to completely install all Insulation, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 04 22 00 CONCRETE MASONRY UNITS
4. 05 12 00 STEEL AND FABRICATIONS
5. 05 30 00 METAL DECK
6. 06 10 00 ROUGH CARPENTRY
7. 07 40 00 METAL PANELS
8. 07 51 13 BUILT-UP ROOFING
9. 07 60 00 SHEET METAL
10. 07 84 00 FIRESTOPPING
11. 08 11 00 METAL DOORS AND FRAMES
12. 09 22 16 METAL FRAMING
13. 09 24 00 CEMENT PLASTER
14. 09 29 00 GYPSUM BOARD
15. 09 50 00 ACOUSTICAL CEILINGS
16. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
17. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 REFERENCES

A. Standards:

1. In accordance with the following standards:
   a. MIMA Mineral Insulation Manufacturers Association
   b. NFPA National Fire Protection Association
   c. TIMA Thermal Insulation Manufacturers Association

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Product Data.
   a. Product Data on materials and accessories.
2. Quality Assurance/Control Submittals:
   a. Manufacturer's Written Instructions:
      1) Submit three (3) copies of manufacturer's written instructions.
3. Closeout Submittals in accordance with the following:
   a. Warranty in accordance with Specification Section - WARRANTIES.

1.4 QUALITY ASSURANCE

A. In accordance with California Quality Standards.

B. The R values for the insulation materials shall be in accordance with "The Standard Mineral Wool Building Insulation" latest Edition of the MIMA.

C. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
a. ASTM American Society for Testing and Materials
b. CDPH California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers”

1.5 DELIVERY, STORAGE, AND HANDLING
A. Delivery and Storage of Materials:
1. All Materials shall be delivered and stored in original unopened packages with manufacturer's name and contents legibly indicated. Materials shall be stored in a dry place, and protected from damage.

1.6 WARRANTY
A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.
B. Manufacturer's Warranty:
1. In accordance with manufacturer's written standard warranty:
a. Warranty Period One (1) Year.
C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES
a. Warranty Period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
1. Specified blanket insulation product manufacturer:
a. OWENS CORNING
b. Acceptable alternative manufacturers:
1) CERTAINTEED
2) JOHNS MANVILLE CORPORATION
2. Specified sound blanket insulation product manufacturer:
a. OWENS CORNING
b. Acceptable alternative manufacturers:
1) CERTAINTEED
2) JOHNS MANVILLE CORPORATION
3. Specified draft stop insulation product manufacturer :
a. THERMAFIBER "Thermafiber."
4. Specified rigid roof board insulation product manufacturer:
a. SARNAFIL "Sarnatherm ISO."
b. Acceptable Alternative Manufacturers:
1) ATLAS.

2) JOHNS MANVILLE CORPORATION.
3) TREMCO.

5. Specified rigid wall board insulation product manufacturer:
   a. RMAX (a SIKA company) "ECOMAXCI FR"
   b. Acceptable Alternative Manufacturers:
      1) ATLAS.
      2) JOHNS MANVILLE CORPORATION.
      3) TREMCO.
6. Specified Foamed-In-Place Insulation product manufacturer:
   a. DOW CHEMICAL "Great Stuff Pro."

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Thermal Blanket:
   1. Construction in accordance with the following:
      a. Type I: Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with a maximum flame-spread and smoke-developed indices of 25 and 50, respectively, per ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials"; passing ASTM E 136 "Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C," for combustion characteristics.
         1) Unless otherwise noted, blankets without vapor-retarder membrane coverings, used in Interior partitions not subject to moisture.
      b. Type II: Kraft-faced, Glass-Fiber Blanket Insulation: ASTM C 665 "Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing," Type II (non-reflective faced), ASTM E 84 Class C (faced surface not rated for flame propagation); Category I (membrane is a vapor barrier).
         1) Unless otherwise noted, this type of insulation should only be used in conditions not "subject to view" (enclosed cavities) or in attics where a finished ceiling is provided and the attic is <u>not</u> used as a return air plenum.
      c. Type III: Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665 "Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing," Type III (reflective faced), ASTM E 84 Class A (faced surface with a foil-scrim or foil-scrim-kraft facing)
         1) Unless otherwise noted, this product shall be used when the attic (although enclosed by a finished ceiling) is used as a return air plenum, or used in "exposed-to-view" exterior and interior walls and ceilings or attics subject to moisture and fire-rated conditions.
   2. Thermal Resistance (R) values required (minimum) for blanket insulation, unless otherwise indicated on the drawings:
      a. Roof Blanket Insulation: R-30.
      b. Wall Blanket Insulation: R-19.
      c. Floor Blanket Insulation: R-30.
      d. Attic Spaces: All attic spaces shall have continuous insulation of the proper type and with a minimum thermal resistance "R" value of R-30 for insulation only. Where attic spaces have vertical elements above ceilings, these shall be insulated as part of the attic space to R-30 minimum.
   3. Thickness: No more than will fit into the space available without compressing. Where insulation is confined between finishes, which would compress the material, high efficiency insulation shall be used to provide the required resistance value.

B. Sound Blanket:

1. Sound Attenuation Batts, unfaced, as manufactured by OWENS CORNING ECOTOUCH SOUND ATTENUATION BATTS, 2-1/2" batts for wood or metal frame construction, complying with ASTM C 665 "Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing," Type I, and ASTM E 136 "Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C."
    a. Flame Spread Index Maximum 25.
    b. Smoke Developed Index Maximum 50.

C. Draft Stop:
1. 2" minimum to 4" thick Safing Insulation, as required on the drawings. Provide manufacturer's written recommended fasteners as required for the specific installation requirements.
    a. Flame Spread and Smoke Developed Index maximum as follows in accordance with ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials":
        1) Unfaced Safing Insulation:
            a) Flame Spread Index 15
            b) Smoke Developed Index 0.
        2) Foil Faced Safing Insulation:
            a) Flame Spread Index 25
            b) Smoke Developed Index 5.

D. Rigid Board:
1. Roof Board:
    a. In accordance with:
        1) ASTM C 1289 "Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board," Type 2, Class 1, isocyanurate with front and back glass fiber/organic mat paper-facers (balanced panel), conditioned "R" value of 8.6 per 1.5 inchs minimum, in accordance with ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials," and ASTM D 1621 "Test method for Compressive Properties of Rigid Cellular Plastics."
            a) Flame Spread Index Maximum, core: 25 or less.
            b) Smoke Density Developed Index Maximum, core: 450 or less.
            c) Compressive strength: 20 PSI.
            d) 4' x 4' or 4' x 8' panels.
2. Wall Board:
    a. Isocyanurate with front and back aluminum foil-faced (balanced panel).
    b. General: Tested to meet NFPA 285 "Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components."
    c. In accordance with:
        1) ASTM C 1289 "Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board," Type 1, Class 1.
        2) ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials," and ASTM D 1621 "Test method for Compressive Properties of Rigid Cellular Plastics."
    d. Properties:
        1) NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Pass.
        2) Flame Spread Index Maximum, ASTM E 84: 25 or less.
        3) Smoke Density Developed Index Maximum, ASTM E 84: 450 or less.
        4) Compressive strength: 25 PSI.
        5) 4' x 4' or 4' x 8' panels.

6) R value per inch: 6.0.

e. 3.7.

E. Foamed-In-Place Insulation:

1. Low Pressure Type: Semi-flexible soft, single-component polyurethane sealant, to CAN/ULC-S710.1, and having the following properties:
   a. Core Density (ASTM D 1622) 1.7 pcf.
   b. Fire Resistance (ASTM E 84) Flame Spread = 10, Smoke Developed = 20.
   c. Color: Yellow.
   d. Cure Time: Approximately 12 hours.
   e. Tack Free Time: 6 - 9 minutes.
   f. Applicator: Gun applied.

2.3 ACCESSORIES

A. Wire:

1. Sixteen (16) gage line wire.

B. All other materials such as fasteners (i.e. insulation netting, line wires, stick-pins), and retainers not specifically described, but required to complete the work, shall be as recommended by approved manufacturer, and installed by the Contractor. Contractor shall choose the appropriate fastener or system for the cavity space or area to be insulated without letting the insulation sag.

1. FSK Tape: As distributed by INSULATION MATERIALS.
   a. VENTURE TAPE product #1525CW.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. All building(s) shall have a complete thermal envelope of thermal blanket or rigid board insulation.
   a. Do not install insulation until the construction has progressed to the point that inclement weather will not damage or wet the insulation material.
   b. Install in accordance with manufacturer's written recommendations.
   c. Insulation shall fit snugly between framing members without voids. Fully insulate all areas between all framing members, cutting and fitting as required.
   d. Attach insulation to inside face of framing members.
      1) Metal Framing: Friction fit to keep from falling down within the cavity and use line wire across metal studs. Omit wire and spot tape with FSK Tape when insulation has a membrane facing.
   e. Vapor-Retarder Membrane: Shall be continuous and without unnecessary joints.
      1) At roof structure and exterior walls, after securing the insulation facing flanges, provide FSK Tape over all of the insulation facing butt joints and all overlapping facing flanges, so as to create a continuous vapor-retarder membrane at underside of the roof deck and inside of walls.
      2) Patch all tears, rips and holes in the vapor-retarder membrane.
   f. Cut and fit insulation material around pipes, conduits and outlet boxes, as necessary to maintain the full integrity of the insulation.

B. At Wall Framing: Install thermal wall blanket insulation between all exterior wall framing members.

C. Sound Insulation:

1. Install sound attenuation batts between all interior wall framing members.
2. Install sound attenuation batts between all floor framing members.
3. Install sound deadening board over interior wall framing members.

D. Draft Stop Insulation:
   1. Install Draft Stop Insulation where required.
E. Rigid Board Insulation:
   1. Install per manufacturer's written recommendations.
   2. Wall Board: Tape all edges as part of the rigid board system.

END OF SECTION

SECTION 074000 – METAL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
   2. This Section includes:
      a. Metal Roof Panels (Flat Sloped Roof Panels)
      b. Metal Wall Panels

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 03 11 01 CONCRETE FORMWORK
   4. 03 30 00 CAST-IN-PLACE CONCRETE
   5. 04 21 13 BRICK MASONRY UNITS
   6. 04 21 30 THIN BRICK VENEER
   7. 04 22 00 CONCRETE MASONRY UNITS
   8. 05 12 00 STEEL AND FABRICATIONS
   9. 05 30 00 METAL DECK
   10. 07 21 00 INSULATION
   11. 07 51 13 BUILT-UP ROOFING
   12. 07 60 00 SHEET METAL
   13. 07 72 00 ROOF ACCESSORIES
   14. 09 22 16 METAL FRAMING
   15. 09 91 00 PAINTING
   16.
   17. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   18. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with the following Standards:
      a. AAMA American Architectural Manufacturers Association
      b. AATCC American Association of Textile Chemists and Colorists
      c. AISC American Institute of Steel Construction.
      d. FMG Factory Mutual Guide (Wind Uplift Requirements for FMG 1A-90 minimum for Metal Roof Panels), or UL Equivalent.
      e. ICC International Code Council (Formerly ICBO)
      f. MBMA Metal Building Manufacturers Association, "Metal Roofing Systems Design Manual".
      g. NAAMM National Association of Architectural Metal Manufacturers.
      h. SMACNA Sheet Metal and Air Conditioning Contractors National Association.

i. TAPPI Technical Association of the Pulp and Paper Industry, Inc.
j. UL Underwriters Laboratories (FMG Equivalent for some manufacturers).

1.3 DEFINITIONS

A. The following definitions apply to this specification section:
1. Waterproof: Any material, treatment, or construction that resists flow or penetration of water (Means Illustrated Construction Dictionary, Third Edition, Unabridged)
2. Weathertight: Generally meaning the ability of the roofing system (including all roof panels, side seams, end laps, roof to wall flashing, ridge flashing, hip flashing, valley flashing, high side eave flashing, rake flashing, expansion joints, curb and penetration flashing, gutters, and wall panels) to prevent water intrusion under normal climatic conditions (including wind and snow conditions) for the area where the project is constructed.
a. Also, the word "Weathertightness" is a variation of the word "weathertight" and shall have the same definition applied. (Definition obtained from various manufacturers warranty literature.)

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: It is the intention of this section and the drawings to form a guide for a complete and operable system. Any items not specifically noted but necessary for a complete and operable system shall be provided under this section.
1. General: Provide metal panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 "Test method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems"at the following test-pressure difference:
1. Test-Pressure Difference: Negative 1.57 lbf/sq. ft.
2. Test-Pressure Difference: Positive and negative 1.57 lbf/sq. ft.
3. Positive Preload Test-Pressure Difference:
a. Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
4. Negative Preload Test-Pressure Difference:
a. 50 percent of design wind-uplift-pressure difference.

C. Water Penetration: No water penetration when tested according to ASTM E 1646 "Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference" at the following test-pressure difference:
1. Test-Pressure Difference: 2.86 lbf/sq. ft. for roof slopes less than or equal to 30 degrees.
2. Test-Pressure Difference:
a. 20 percent of positive design wind pressure, but not less than 6.24 lbf/sq. ft. and not more than 12.0 lbf/sq. ft. for roof slopes steeper than 30 degrees.
3. Positive Preload Test-Pressure Difference:
a. Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
4. Negative Preload Test-Pressure Difference:
a. 50 percent of design wind-uplift-pressure difference.

D. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
   1. Fire/Windstorm Classification: Class 1A-90.
   2. Hail Resistance: MH Moderate Hail.
   3. Hail Resistance: SH Severe Hail.

E. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592 "Test method for Structural Performance of Sheet metal Roof and Siding Systems by Uniform Static Air Pressure Difference".
   1. Wind Loads: Determine loads based on the following minimum design wind pressures:
      a. Uniform pressure as indicated on Drawings.
   2. Deflection Limits: Engineer metal roof panel assemblies to withstand design loads with vertical deflections no greater than 1/180 of the span.

F. Seismic Performance: Provide metal roof panel assemblies capable of withstanding the effects of earthquake motions determined according to ASCE 7, and CBC 1616A.

G. Thermal Movements: Provide metal roof panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Coordination Drawings: Roof plans and Wall Elevations drawn to scale, coordinating penetrations and roof-and/or wall-mounted items. Show the following:
      a. Roof panels and attachments.
      b. Purlins and Rafters.
      c. Wall Panels and attachments.
      d. Roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
      e. Wall-mounted items including supports, pipe supports and penetrations.
   2. Product Data.
      a. Material List and product information regarding material composition, product names, profiles, shapes, finishes, and application for each item.
      b. Submit manufacturer’s standard color range for selection by the Architect.
      c. Submit manufacturer's full color range (including any standard, premium and custom colors) of all metal panels and exposed components for selection by the Architect.
   3. Shop Drawings.
      a. Submit shop drawings and Structural Calculations prepared by the manufacturer under the supervision of a registered Civil or Structural Engineer in the State of California, detailing fabrication and assembly of the work under this section, as well as procedures and diagrams. Include setting drawings, templates, and directions for installation of anchor bolts and other anchorage to be installed as unit of work of other related sections.

1) Manufacturer shall prepare, review and approve all drawings and shop drawings prior to submittal to the Architect.
   a) Calculations shall include design wind load pressures for components and cladding (walls and roofs) in accordance with CBC 1609A.
   b) Calculations shall also include checks for panel spans between attachment points.
   c) Check of attachment hardware to panel.
   d) Check of fasteners connecting panel hardware to structure,
2) Manufacturer shall approve of all details (including Architects standard details) prior to fabrication. If different details than the Architects details are required to satisfy manufacturers warranty requirements, submit the differences (highlighted as to differences) to the Architect for review.
3) Show fabrication and installation layouts of metal roof panels; details of edge conditions, joints, lap seams, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
4) Include details of the following accessory items, at a scale of not less than 1-1/2 inches per 12 inches:
   a) Flashing and trim.
   b) Gutters.
   c) Downspouts.
   d) Roof curbs.

4. Samples.
   a. For each type of exposed finish required, prepared on Samples of size indicated below.
      1) Metal Panels: Provide 12 inches long by actual panel width.
      2) Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
      3) Roof Underlayment: 6 inch square samples.
      4) Vapor Retarders: 6 inch square samples.
      5) Water Barriers: 6 inch square samples.
      6) Accessories: 12 inch long samples for each type of accessory.
      7) Provide two (2) fasteners with any neoprene washers, metal washers, nuts or rivets for every type of fastener condition on this Project. Tag and label each fastener indicating that location and use for each fastener condition on this project.
5. Quality Assurance/Control Submittals:
   a. Installer Qualifications:
      1) Submit three (3) copies of manufacturer's Installer Certification.
   b. Manufacturer's Written Instructions:
      1) Submit three (3) copies of manufacturer's written instructions.
   c. Manufacturer's Field Reports:
      1) Submit three (3) copies of manufacturer's field reports.
   d. Manufacturer's Test Reports:
      1) Provide Test Reports per ASTM E 1592 or FM 4474.
   e. Engineering Calculations:
      1) Submit four (4) copies of engineering calculations computed and signed by a registered Civil or Structural Engineer in the State of California.
6. Closeout Submittals in accordance with the following:
   a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
   b. Project Record Documents in accordance with Specification Section - PROJECT RECORD Documents.

c. Warranty in accordance with Specification Section - WARRANTIES.
   1) Special Warranties:
      a) Twenty (20) Year Weather Tightness Warranty.
      b) Five (5) Year Installation Warranty.
      c) Twenty (20) Year Finish Warranty.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
      b. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
         1) Installer shall have manufacturers signed Certified Installer Agreement as a rider to the warranty.
   2. Manufacturer/Supplier Qualifications:
      a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
      b. Manufacturer shall inspect during installation and after completion and report to the Architect.
         1) A factory trained representative approved by the manufacturer shall visit the project site a minimum of five (5) times, in order to review the installation of the metal panels, and provide a follow-up written report for the following periods in the construction schedule.
            a) At the preliminary metal panel conference.
            b) During the first week of installation, in order to review the installation requirements.
            c) When the metal panel installation is approximately 50% complete
            d) Upon completion of the metal panel installation.
            e) When punch list and corrections have been completed

B. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
      a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA), in the area where the project is located.

C. Meetings:
   1. Preliminary Metal Panel Conference: Before starting roof deck and wall panel, sheathing, wood joists or purlin and rafter construction, conduct conference scheduled by the Contractor at Project site. Review methods and procedures related to roof construction and metal roof panels including, but not limited to, the following:
      a. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal panel installer, metal panel manufacturer's representative, deck, sheathing, wood joists or purlin and rafter installer, and installers whose work interfaces with or affects metal panels including installers of metal panel accessories and roof-mounted equipment.

1) Review wood blocking layout (if any) required for metal panel fastener / anchorage system.

b. Coordinate the work with all other related work.

c. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

d. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.

e. Examine conditions for compliance with requirements, including flatness and attachment to structural members.

f. Review structural loading limitations of metal panel substrate construction during and after roofing and wall construction.

g. Review metal panel flashings, special metal panel details, metal panel drainage, metal panel penetrations, equipment curbs, and condition of other construction that will affect metal panels.

h. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.

i. Review temporary protection requirements for metal panels during and after installation.

j. Review metal panel observation and repair procedures after metal panel installation.

k. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.

2. Progress Meetings: Scheduled by the Contractor for the proper performance of the work.

a. Review for proper installation of work progress.

b. Identify any installation problems and acceptable corrective measures.

c. Identify any measures to maintain or regain project schedule of necessary.

3. Final Inspection: Scheduled by the Contractor upon proper completion of the work.

a. Inspect and identify any problems that may impede issuance of warranties or guaranties.

b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal panels from exposure to sunlight and high humidity, except to extent necessary for period of metal panel installation.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of metal panel framing and metal panel opening dimensions by field measurements before metal panel fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal panels without field measurements, or allow for field-trimming of panels. Coordinate metal panel construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations, which are specified in Specification Section - ROOF ACCESSORIES.

B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of metal panel substrate, parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.
   2. Installer shall have manufacturers signed Certified Installer Agreement as a rider to the warranty.

B. Manufacturer's Warranty:
   1. Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
      a. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
         1) Color fading more than 5 Hunter units when tested according to ASTM D 2244 "Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Coordinates".
         2) Chalking in excess of a No. 8 rating when tested according to ASTM D 4214 "Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films".
         3) Cracking, checking, peeling, or failure of paint to adhere to bare metal.
      b. Finish Warranty Period: 20 years from date of Substantial Completion.
         1) All costs for Warranty shall be included in the bid price. There shall be no additional costs associated with the implementation or maintaining of the warranty.
   2. Weathertightness Warranty for Standing-Seam Metal Roof Panels:
      a. Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
         1) Warranty shall include roof panel side seams, end laps, roof to wall flashing, ridge flashing, hip flashing, valley flashing, high side eave flashing, rake flashing, approved expansion joints, approved curb and penetration flashing, approved gutters and built-in gutters, and approved wall systems.

2) A Factory trained manufacturer representative approved by the manufacturer shall inspect during and at completion of installation and certify that the system is acceptable to the manufacturer's weathertightness standards.

b. Warranty Period: 20 years from date of Substantial Completion.

C. Installer's Warranty:

1. In accordance with the terms of the Specification Section - WARRANTIES
   a. Warranty Period Five (5) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified Flat Sloped Roof Panel (Standing Seam) product manufacturer:
   a. T-Armor Panel (Metal Sales) Mesa
2. Specified Standing Seam Exterior Wall Panel product manufacturer:
   a. T-Armor Panel (Metal Sales) Mesa
3. Specified Inverted Box Rib Exterior Wall Panel product manufacturer:
   a. T6-A Panel (Metal Sales) STYLE RIB.
4. Specified Corrugated Type 1 Parapet product manufacturer:
   a. 7/8” Corrugated (Metal Sales) 7/8” Corrugated
5. Specified Corrugated Type 2 Exterior Wall Panel product manufacturer:
   a. Western State Metal: 7/8" STRUCTURAL CORRUGATED
6. Specified Corrugated Type 3 Exterior Wall Panel product manufacturer:
   a. Western State Metal: 7/8” STRUCTURAL CORRUGATED PERFORATED
7. REFER to Schedule at end and update to include all panels indicated.
8. Specified Vapor Retarder:
   a. REEF INDUSTRIES GRIFFOLYN T-65.
9. Specified Roof Underlayment product manufacturer:
   a. TYPAR ROOF WRAP 30.
10. Specified Water Barrier (also qualifies as an "Air Barrier"):
    a. TYVEK COMMERCIAL WRAP.
    b. Acceptable alternative manufacturers:
       1) TYPAR METRO WRAP.
11. Specified Ice and Water Shield:
    a. GCP APPLIED TECHNOLOGIES; CE and WATER SHIELD HT.
       1) Formerly GRACE CONSTRUCTION PRODUCTS.
    b. Acceptable alternative manufacturers:
       1) CARLISLE COATINGS & WATERPROOFING CCW WIP 300HT.
12. Specified Insulation:
    a. Acoustical Fiberglass OWENS-CORNING FIBERGLASS.
    b. Rigid Board
       1) Roof and Wall Conditions - see drawings.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Properties:

1. Panels: Metallic-Coated Steel Sheet Prepainted with Coil Coating composed of steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755 "Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products". See Schedule Article at the end of this section for profiles and manufacturer/product names, gages, application and finish requirements.
   a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process", G90 coating designation; structural quality.
2. Flashing and Trim: Formed from zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet (minimum thickness and material to match gage of Metal Panels, unless noted otherwise) pre-painted with coil coating. Provide custom profile shape flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fascia, and fillers. Finish flashing and trim with same finish system as adjacent metal panels. All pieces shall have self-hemmed edges fully pre-finished. No raw or field painted cut-edges will be permitted.
   a. Provide components required for a complete metal panel assembly including trim, copings, fascia, corner units, closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels, unless otherwise indicated.
   b. Exactly matching materials, gage of Metal Panels, profile, texture and pre-finish.
   c. Supply in continuous lengths as long as possible with minimal seams the full extent of the roof.
   d. As required for a pre-finished, weathertight assembly.
   e. All metal work that comes in contact with and/or is an accessory to the metal panels shall be provided and installed by the Metal Panel Manufacturer from the same materials as the Metal Panels.
   f. Mylar-Coated Tape: 1/4 inch x 1 inch with PSA one side and Mylar one side where required by the manufacturer.
3. Gutters: Formed from stainless steel sheet (minimum thickness to match gage of Metal Panels, unless noted otherwise) pre-painted with coil coating. Match profile of trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, sized according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced 36 inches o.c., fabricated from same metal as gutters, unless noted otherwise. Provide bronze, copper, or aluminum wire ball strainers at outlets. Finish gutters to match metal roof panels.
4. Roof Curbs: Fabricated from 0.0747-inch- thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet pre-painted with coil coating, with welded top box and bottom skirt, and integral full-length cricket, unless noted otherwise. Fabricate curb sub-framing of minimum 0.0747-inch- thick, angle-, C-, or Z-shaped steel sheet, unless noted otherwise. Fabricate curb and sub-framing to withstand indicated loads, of size and height indicated. Finish roof curbs to match metal roof panels.
   a. Insulate roof curb with 1-inch- thick minimum, rigid insulation.

B. Vapor Retarder: Provide GRIFFOLYN "T-65".

1. Performance Requirements:
   a. Water Vapor Permeance 0.038 grams/hr·ft2·in·Hg.

1) Per ASTM E-96 "Standard Test Methods for Water Vapor Transmission of Materials".

2. Accessories:
   a. Seam Tape GRIFFOLYN "FAB TAPE".
   b. Repair Tape GRIFFOLYN "GRIFF-TAPE".

C. Roof Underlayment: Provide "TYPAR ROOF WRAP 30" with compatible lap seam tape, or approved equivalent.
1. Performance Requirements:
   a. Gurley Hill (TAPPI T-460): Greater than 2500 sec/100cc.
   b. Water Vapor Transmission per ASTM E-96 "Standard Test Methods for Water Vapor Transmission of Materials", Method A:
      1) Greater than 13 perms.
   c. Water Penetration Resistance per AATCC-127: 165 cm on Hydrostatic Head.
   d. Trapezoidal Test per ASTM D 5733 "Standard Test Method for Tearing Strength of Nonwoven Fabrics by the Trapezoid Procedure":
      1) Equal to 68 / 67.

D. Water Barrier (also qualifies as an "Air Barrier"): Provide "TYVEK" "Commercial Wrap" with compatible lap seam tape, or approved equivalent, that complies with 60 Water Resistant, Grade D, in accordance with CBC Sections 1404.2 and 2510.6.
1. Provide manufacturer's preformed tape and recommended cap fasteners for attachment.
2. Seam and Repair Tape: DUPONT "TYVEK 3" WIDE TAPE".

E. Ice and Water Shield: Self-Adhering, Polyethylene-Faced Sheet, ASTM D 1970 "Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection", 40 mils thick minimum, elongation from 250 percent to 300 percent, consisting of slip-resisting polyethylene-film reinforcing and top surface laminated to SBS-modified asphalt adhesive, with release-paper backing; cold applied.

F. Insulation:
1. Acoustical Fiberglass: ASTM C 665 "Standard Guide for Determination of the Thermal Resistance of Low-Density Blanket-Type Mineral Fiber Insulation", type indicated below; consisting of fibers manufactured from glass, Class 1, sized to fit the interior liner panel profile.
   a. Type I (blankets without membrane covering), passing ASTM E 136 "Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C", for combustion characteristics.
2. Roof Curb (1 inch thick minimum unless otherwise noted):
   a. Un-faced, Glass-Fiber Board Insulation: ASTM C 612 "Standard Specification for Mineral Fiber Block and Board Thermal Insulation", Type IA or Types IA and IB; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; and with a nominal density of 3 lb/cu. ft. and thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F.
3. Rigid Board -Wall (1 inch thick minimum unless otherwise noted):
   a. In accordance with ASTM C 1289 "Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board", Type II, Class 1, isocyanurate with top and bottom surface glass fiber/organic mat facer on both sides (balanced panel), conditioned "R" value of 5.70 per inch.
      1) Flame Spread Index: 0 - 25, in accordance with ASTM E84 "Standard Test Method for Surface Burning Characteristics of Building Materials".
      2) Smoke Density Developed Index: 0 - 450 in accordance with ASTM E84 "Standard Test Method for Surface Burning Characteristics of Building Materials".

3) Compressive Strength: 20 PSI, in accordance with ASTM D 1621 "Standard Test Method for Compressive Properties Of Rigid Cellular Plastics".
4) 4' x 4' or 4' x 8' panels.

4. Rigid Board- Roof (5-1/2 inch thick overall unless otherwise noted):
   a. Between framing members.
      1) In accordance with ASTM C 1289 "Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board", Type II, Class 1, isocyanurate with top and bottom surface glass fiber/organic mat facer on both sides (balanced panel), conditioned "R" value of 5.70 per inch.
         a) Flame Spread Index: 0 - 25, in accordance with ASTM E84 "Standard Test Method for Surface Burning Characteristics of Building Materials".
         b) Smoke Density Developed Index: 0 - 450 in accordance with ASTM E84 "Standard Test Method for Surface Burning Characteristics of Building Materials".
         c) Compressive Strength: 20 PSI, in accordance with ASTM D 1621 "Standard Test Method for Compressive Properties Of Rigid Cellular Plastics".
         d) 4' x 4' or 4' x 8' panels.

G. Furring:
1. General: Comply with ASTM C 754 "Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products" for conditions indicated.
   a. Steel Sheet Components: Complying with ASTM C 645 "Standard Specification for Nonstructural Steel Framing Members" requirements for metal and with ASTM A 653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process", G60, hot-dip galvanized zinc coating.
2. Hat Channels (Subgirts): In accordance with ASTM C 645 "Standard Specification for Nonstructural Steel Framing Members".
   a. Minimum Base Metal Thickness: Appropriate to depth indicated.
   b. Depth: As indicated.
3. Cold-Rolled Channels: Thickness appropriate to span, bare steel with minimum 1/2-inch-wide flange.
   a. Depth: As indicated.
   b. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of 0.0747 inch.
   c. Tie Wire: ASTM A 641 "Standard Specification for Zinc–Coated (Galvanized) Carbon Steel Wire", Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.
4. Zee Channels:
   a. At Roofs: Provide in depth as indicated.
   b. At Walls: Provide in depth as indicated.
      1) Zee Channels: With slotted or non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare metal thickness of 0.059 inch, and depth required to fit insulation thickness indicated.

2.3 ACCESSORIES

A. Profile Closures:
1. Metal: Exposed To View:
   a. Provide metal closures, fabricated of same metal as metal roof panels.

2. Neoprene: Concealed from view:
   a. Provide closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or pre-molded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction and to prevent nesting of birds or insects.

B. Clips: Minimum 0.060 -inch-thick, Galvanized or stainless steel panel clips per manufacturer's written recommendations (stainless steel clips only for aluminum or stainless panels) designed to withstand negative-load requirements.
   1. Compatible material and size with Standing Seam Roof System.

C. Cleats: Mechanically seamed cleats formed from minimum 0.0359-inch-thick, stainless-steel.

D. Backing Plates: Provide metal backing plates at panel end splices, fabricated from non-corrosive material recommended in writing by manufacturer.

E. Sealants:
   1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
   2. Joint Sealant: ASTM C 920 "Standard Specification for Elastomeric Joint Sealants"; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
   3. Butyl-Rubber-Based, Solvent-Release Sealant: In accordance with ASTM C 1311 "Standard Specification for Solvent Release Sealants".

F. Fasteners:
   1. Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating.
      a. Fasteners for Metal Panels: Self-drilling or self-tapping type 304 stainless hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal roof panels.
      b. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
         1) Blind Fasteners: Stainless Steel Blind Rivets.
      c. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
      d. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
   1. Fabricate panels in longest practical lengths possible (20 foot minimum) to minimize seaming and lapping. See drawings for Curved Roof panel lengths for longer length and lapping requirements.

2. Sound Control: Where sound-absorption requirements are indicated for liner panels, fabricate with 1/8 inch diameter holes at 3/8" o.c. staggered with a 10 percent free area.

B. Provide panel profile, including major ribs for full length of panel.

C. Fabricate metal panel joints with factory-installed butyl sealant that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.

D. Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal roof panel manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal roof panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Exterior Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings for all exterior metal panels.

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces (both sides of panel when both sides are exposed to view) to comply with coating and resin manufacturers' written instructions.
    a. Fluoropolymer Three-Coat System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil; complying with physical properties and coating performance requirements of ASTM D 2247 "Standard Practice for Testing Water Resistance of Coatings in 100 percent Relative Humidity", except as modified below:

1) Humidity Resistance: 2000 hours.
2) Water Resistance: 2000 hours.

2. Durability: Provide coating field tested under normal range of weather conditions for a minimum of 20 years without significant peel, blister, flake, chip, crack, or check in finish; without chalking in excess of a chalk rating of 8 according to ASTM D 4214 "Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films"; and without fading in excess of 5 Hunter Units.
3. Color: "Custom Colors" as selected by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of work.
1. Examine primary and secondary metal panel framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal panel manufacturer.
2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before metal panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
1. When applying Ice and Water Shield products, clean and prime the substrates in accordance with the manufacturer's written recommendations.

B. Install flashings and other sheet metal to comply with requirements specified in Specification Section SHEET METAL flashing and trim.

C. Install fascia and copings to comply with SMACNA requirements specified in Specification Sections - SHEET METAL and ROOF ACCESSORIES.

D. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous metal panel support members and anchorage according to metal panel manufacturer's written recommendations.

3.3 INSTALLATION

A. Roof Panel Installation:
1. Metal Roof Panel over Metal Roof Deck:

a. Place the vapor retarder on metal roof decks within the zee furring. Lap vapor retarder joints 6 inches minimum and adhesively attach in accordance with roofing manufacturer's written recommendations and in accordance with manufacturer's warranty requirements, to provide a continuous uninterrupted membrane. Tape all joints with compatible tape. Repair any holes or damage to vapor retarder with compatible repair tape.

b. All fastening shall be done in accordance with FMG 1A-90 and manufacturer's written recommendations for the type of panel and fastening system required.
   1) Submit fastening schedule along with all shop drawings showing the type of fastener and the spacing required.

c. Insulation Board: Install insulation boards over roof deck on entire roof surface in thicknesses as indicated on the drawings.
   1) Install insulation board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
   2) Erect insulation horizontally and hold in place with zee furring spaced in accordance with wind uplift requirements. Securely attach narrow flanges of furring members to deck with welds in accordance with wind uplift requirements.

d. Place a layer of vapor retarder over installed insulation boards. Lap vapor retarder joints 6 inches minimum and adhesively attach in accordance with roof underlayment manufacturer's written recommendations and in accordance with manufacturer's warranty requirements, to provide a continuous uninterrupted membrane. Tape all joints with compatible tape. Repair any holes or damage to vapor retarder with compatible repair tape.

2. Metal Roof Panel Installation:

a. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1) Provide Ice and Water Shield at all eaves, ridges, hips, valleys & gutters in accordance with roof panel manufacturer's written recommendations.
   2) Field cutting of metal panels by torch is not permitted.
   3) Install panels perpendicular to purlins.
   4) Rigidly fasten ridge end of flat sloped metal roof panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
   5) Provide metal closures at peaks, rake edges, rake walls and each side of ridge and hip caps.
   6) Flash and seal metal panels with profile closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
   7) Locate and space fastenings in uniform vertical and horizontal alignment.
   8) Install ridge and hip caps as metal panel work proceeds.
   9) All panels shall be fabricated in continuous lengths whenever possible to eliminate lap seams. When lap seams are unavoidable, locate panel splices over, but not attached to, structural supports. Locations of lap seams shall be submitted to the Architect for review as part of the submittal process. Panels that require lap seams shall be in the longest possible lengths to minimize the overall number of lap seams per roof area.
      a) Provide ice and water shield at all lap joints in accordance with metal roof panel manufacturer's written recommendations for a watertight seal. Follow manufacturer's cleaning and priming recommendations prior to application of this product.
      b) Length of lap seals shall be in accordance with manufacturer's warranty requirements for watertight seals.

10) Lap metal flashing over metal panels to allow moisture to run over and off the material.

3. Fasteners:
   a. Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.
4. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
5. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal panel manufacturer.
   a. Seal metal panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal panel manufacturer.
   b. Prepare joints and apply sealants to comply with requirements in Specification Section - SEALANTS.

B. Exterior Wall Panel System:
1. Wall Panel Installation over Metal Framing:
   a. Place the one layer of the water barrier on wall framing. Lap water barrier joints 6 inches minimum and adhesively attach in accordance with water barrier manufacturer's written recommendations and in accordance with manufacturer's warranty requirements, to provide a continuous uninterrupted membrane. Tape all joints with compatible tape. Repair any holes or damage with compatible tape.
   b. Provide metal wall panels of full length from sill to top plate, unless otherwise indicated or restricted by shipping limitations. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
2. Fasteners:
   a. Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.
      1) All fastening shall be done in accordance with manufacturer's written recommendations for the type of panel and fastening system required.
         a) Submit fastening schedule along with all shop drawings showing the type of fastener and the spacing required.
         b) Locate and space fastenings in uniform vertical and horizontal alignment.
   b. Field cutting of metal wall panels by torch is not permitted.
      1) Install panels perpendicular to wall blocking or subgirts.
      2) Provide metal and neoprene closures at bottom and top of metal wall panels.
      3) Flash and seal metal wall panels with weather closures at perimeter of all openings. Fasten with self-tapping screws.
      4) Locate and space fastenings in uniform vertical and horizontal alignment.
      5) All panels shall be fabricated in continuous lengths whenever possible to eliminate lap seams. When lap seams are unavoidable, locate panel splices over, but not attached to, structural supports. Locations of lap seams shall be submitted to the Architect for review as part of the submittal process. Panels that require lap seams shall be in the longest possible lengths to minimize the overall number of lap seams per wall area.
         a) Length of lap seals shall be in accordance with manufacturer's warranty requirements for watertight seals.
      6) Lap metal flashing over metal wall panels to allow moisture to run over and off the material.

3. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.
4. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
    a. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
    b. Prepare joints and apply sealants to comply with requirements in Specification Section - SEALANTS.

C. Accessory Installation:
1. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
    a. Install components required for a complete metal panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
    a. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
    b. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
3. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 4 feet o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
4. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
    a. Provide elbows at base of downspouts to direct water away from building.
    b. Tie downspouts to underground drainage system when indicated.
5. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
6. Pipe Flashing: Form flashing around pipe penetration and metal panels. Fasten and seal to metal panels as recommended by manufacturer.

3.4 FIELD QUALITY CONTROL

A. Erection Tolerances:

1. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal panel installation, including accessories. Report results in writing.

C. Remove and replace applications of metal panels where inspections indicate that they do not comply with specified requirements.

D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.

B. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

3.6 SCHEDULES

A. Metal Panel Schedule:

1. Exterior Roof Flat Sloped:
   a. Style: Standing Seam, low slope.
   b. Manufacturer: METAL SALES.
   c. Type: T-Armor Panel. “Mesa” Profile
   d. Gage: 22.
   e. Size: 3" nominal high seams x 18" wide panels.
   f. Finish: "Fluoropolymer" 3-coat system.
   g. Remarks: Provide 1-1/4"wide "T" shaped caps.
2. Exterior Wall:{EXTERIOR WALL PANEL}
   a. Style: Standing Seam.
   b. Manufacturer: METAL SALES.
   c. Type: T-Armor Panel “Mesa” Profile
   d. Gage: 22.
   e. Size: 3" nominal high seams x 18" wide panels.
   f. Finish: "Fluoropolymer" 3-coat system, one side only.
   g. Remarks: Provide 1-1/4"wide "T" shaped caps.
3. Exterior Wall:
   a. Style: Inverted Box Rib.
   b. Manufacturer: METAL SALES.
   c. Type: Inverted Box Rib, T6-A , exposed fastener.
   d. Gage: 22.
   e. Size: 1-1/2" deep x 36" coverage, 7.2" o.c. rib spacing.
   f. Finish: "Fluoropolymer" 3-coat system, one side only.
   g. Remarks: N/A.
4. Parapet:
   a. Style: Corrugated (Type 1)

b. Manufacturer: METAL SALES .
c. Type: 7/8", exposed fastener.
d. Gage: 22.
e. Size: 7/8" deep x 37" coverage.
f. Finish: "Fluoropolymer" 3-coat system.
g. Remarks: N/A.

5. Exterior Wall:
   a. Style: Corrugated, (Type 2)
   b. Manufacturer: Western State Metal
   c. Type: Corrugated 7/8", exposed fastener.
   d. Gage: 22.
   e. Size: 7/8" deep x 34 2/3" coverage.
   f. Finish: Fresh Rust
   g. Remarks: N/A.
6. Exterior Screen:
   a. Style: Perforated & Corrugated (Type 3)
   b. Manufacturer: Western State Metal
   c. Type: Corrugated 7/8",
   d. Gage: 20.
   e. Size: 7/8" deep x 34 2/3" coverage.
   f. Finish: Fresh Rust
   g. Panel Perforation:
      1) Open/ Free Area Percentage: 33%
         a) Pattern: Staggered
         b) Diameter: 3/16"
         c) Spacing: 5/16"

END OF SECTION

SECTION 074243 – FIBER-CEMENT PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary for complete installation of Wall, Soffit and Facade Fiber-Cement Panel "Ventilated Rainscreen" System, Water Barrier, Insulation and other related items necessary to complete the Project as indicated by the Contract Documents.
      a. Pre-fabricated Fiber-Cement Panels, engineered support structure, and related accessories.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 07 21 00 INSULATION
   4. 07 40 00 METAL PANELS
   5. 07 60 00 SHEET METAL
   6. 07 92 00 SEALANTS
   7. 08 11 00 METAL DOORS AND FRAMES
   8. 08 41 00 STOREFRONTS
   9. 09 22 16 METAL FRAMING
   10. 09 24 00 CEMENT PLASTER
   11. 09 29 00 GYPSUM BOARD
   12. 09 91 00 PAINTING
   13. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with the following standards:
      a. AAMA American Architectural Manufacturers Association
      b. ASTM American Society of Testing and Materials
      c. NFPA National Fire Protection Association

1.3 DEFINITIONS

A. The following definitions apply to this specification section
   1. Panel System: Wall panels, attachment components, miscellaneous framing, and accessories necessary for a complete weathertight wall system.
   2. Weathertight: The ability to prevent water intrusion into the building under normal climatic conditions (including pressure differentials, wind, and snow conditions) for the area where the project is constructed. Also the word “weathertightness" is a variation of the word “weathertight" and shall have the same definition applied.

1.4 SYSTEM DESCRIPTION

A. Design Requirements:
1. Provide a high performance “Ventilated Rainscreen" Fiber-Cement Panel System.
2. The Fiber-Cement Panel System shall consist of factory-molded, ultra high performance concrete (UHPC) solid exterior panels associated UHPC framing components with engineered support structure (subframe) materials, accessories and other miscellaneous accessories as required for a complete watertight installation.
   a. Any items not specifically noted but necessary for a complete and watertight system shall be provided.
3. The Fiber-Cement Panel System shall be designed to provide controlled drainage to the exterior face of the wall for any leakage of water and condensation taking place within the panel system.

B. Performance Requirements:
1. General: Provide “Ventilated Rainscreen" Fiber-Cement Panel System that comply with performance requirements without failure due to defective manufacture, fabrication, installation or other defects in construction.
   a. Design panel system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Fiber-Cement Panels shall comply to ASTM C 1185 and ASTM C120.
   a. Density - Thin Panel: 137 lbs./ft³
   b. Flexural Strength (Thin Panel) - Dry: Pass, Mean length direction not less than 3,800 lbs/in2 and width direction 3,600 lbs/in2.
   c. Water Absorption - less than 46.0% nominal 20% maximum.
   d. Water Tightness: No water droplet formation.
3. Surface Burning Characteristics per ASTM E 84:
   a. Flame Spread: Pass.
   b. Smoke Developed: Pass.
   c. Class A.
4. Fire Performance meeting NFPA 285.
5. Non Combustible per ASTM E 136.
6. Compressive Strength per ASTM C 873: Greater than or equal to 18,332 lbs./in²
7. Tensile Strength per ASTM C 496: Splitting matrix prism: 1,319 lbs./in².
8. Colorfastness & Weathering (500 hours) per ASTM G 155 and ASTM D 2244.
   a. 2.07 delta E. without coating (standard, varies with pigment type, texture and coating (consult with manufacturer for color information).
9. Anchor Pullout Strength per ASTM E 488:
   a. 8.5 mm embed in 13mm thick panel.
   b. Tension (Min. Mean) Peak Load - 386 lbf or greater.
   c. Shear (Min. Mean) Peak Load - 650 lbf or greater,

1.5 SUBMITTALS

A. General: Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

B. Product Data:
1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
2. Submit manufacturer’s standard color range for selection by the Architect.

3. Manufacturer’s Details: Submit drawings (*.pdf formats), including plans, sections, showing installation details that demonstrate product dimensions, edge/termination conditions/treatments, compression and control joints, corners, openings, and penetrations.

C. Shop Drawings.
   1. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loading, required clearances, method of field assembly, components, and location and size of each field connection.
      a. Panel elevations, sections, and dimensions.
      b. Panel thickness and fastener type and size.
      c. Finishes.
      d. Joint and connection details.
      e. Erection details.
      f. Panel cut-outs for Mechanical, Electrical, Plumbing, and Security devices and items.
      g. Panel frame details for typical panels including sizes, spacings, thicknesses, and yield strengths of various members.
      h. Locations and details of connection hardware attached to structure.
      i. Sizes, locations, and details of flex, gravity, and seismic anchors for typical panels.
      j. Erection sequence for special conditions.
      k. Relationship to adjacent materials.
      l. Shop Drawings for Mockups: Include plans, elevations, sections, full-size details, and attachments to other work.

D. Samples.
   1. Submit samples of each product type proposed for use.
      a. Representative of finished exposed face of solid exterior UHPC panel. For each color and pattern specified, submit a minimum of two samples, each not less than 6 by 6 inches, and of actual thickness. Each sample to be labeled and dated. Approved sample to be stamped approved and returned to manufacturer for reference.

E. Quality Assurance/Control Submittals:
   1. Provide manufacturer's Tolerances and Acceptance Criteria prior to any panel fabrication for the Architect's review.

F. Closeout Submittals in accordance with the following:
   1. Operation and Maintenance Data:
      a. Operation and maintenance data for installed products in accordance with Specification Section - SUBMITTALS.
      b. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
   2. Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.

b. All products listed in this section are to be installed by a single installer trained by manufacturer or representative.
c. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's written warranty requirements.

2. Manufacturer/Supplier Qualifications:
   a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
   b. All fiber cement panels specified in this section must be supplied by a manufacturer with a minimum of 5 years of experience in fabricating and supplying fiber cement cladding systems.
      1) Products covered under this section are to be manufactured in an ISO 9001 certified facility.

B. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
      a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA), in the area where the Project is located.

C. Mockups:
   1. Build mockup indicated on Drawings to verify selections made under sample submittals, and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   2. Build mockup, including insulation, supports, attachments, and accessories for typical conditions/parts not to exceed one (1) window surround , cornice section and or building corner and not more than 100 square foot area.
   3. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

D. Meetings:
   1. Pre-Installation:
      a. Coordinate the work with other work being performed.
      b. Identify any potential problems, which may impede planned progress and proper installation of work.
      c. Review structural load limitations of existing structure.
      d. Review areas where existing construction is to remain and requires protection.
   2. Progress: Scheduled by the Contactor during the performance of the work.
      a. Review for proper work progress.
      b. Identify any problems and acceptable corrective measures.
      c. Identify any measures to maintain or regain project schedule if necessary.
   3. Completion: Scheduled by the Contactor upon proper completion of the work.
      a. Inspect and identify any problems.
      b. Establish method and procedures to maintain protections while progressing to project completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
   1. Products shall be individually wrapped.

2. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:
1. Deliver exterior solid UHPC wall panels and support system components packaged to comply with manufacturers' requirements and adequately protected from damage during shipment.
2. Panels are to be stored and handled vertically until installed.
3. Damaged products will not be accepted.

C. Storage and protection:
1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
   a. Protect components from adverse job conditions prior to installation.
   b. Protect components from damage after installation including staining or solvents used in adjacent work, impact damage and abrasion, etc.
   c. Panels are to be stored and handled vertically until installed.
   d. Store with non-staining resilient spacers between panels, with suitable ventilation.
   e. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.8 PROJECT CONDITIONS

A. Environmental requirements:
1. Dust control: Perform work in a manner as to minimize the spread of dust and flying particles. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other on-site work.
2. Burning: No burning will be allowed on-site.
3. Rain: The work under this section shall not be started or maintained under threat of rain unless the work is not affected by the rain.

B. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.
3. Field Measurements:
   a. Verify actual measurements/openings by field measurements before material fabrication, and show recorded measurements on approved shop drawings, as required.
   b. Coordinate shop drawings and field measurements with adjacent work/assemblies and with associated trades/sub-contractors prior to finalizing shop drawings.
   c. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.9 WARRANTY

A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer’s Warranty:
1. In accordance with manufacturer's written standard warranty for defects in fiber cement panels:
a. Warranty Period Twenty (20) Years.

C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES:
a. Warranty period Two (2) years.

1.10 MAINTENANCE

A. Extra Material:
1. Furnish to Owner not less than 5 percent of each color of each pattern of 5' x 1' Fiber-Cement Panels Installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products specified are from companies listed below, or approved equivalent. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers must still comply with the requirements of the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
1. Water Barriers:
a. Building Wrap (also qualifies as an "Air Barrier"):
1) TYVEK "Commercial Wrap".
2) Acceptable alternative manufacturers:
a) TYPAR "Metro Wrap".
b. Sealing Tape:
1) DUPONT 3" wide tape "Tyvek 3".
2) Acceptable alternative manufacturers:
a) 3M COMPANY "8086 Construction Sheathing Tape".
b) CANTECH INDUSTRIES "Clipper Tape".
2. Penetration Flashing:
a. GRACE CONSTRUCTION PRODUCTS "Vycor V40".
b. Acceptable alternative manufacturers:
1) FORTIFIBER "Fort-I-Flash 40".
2) TYVEK "Flex Wrap" and "Straight Flash".
3. Support Structure:
a. "Z" Furring Channels, Hat Channels, and Steel Accessories specified product manufacturer:
1) CLARK DIETRICH BUILDING SYSTEMS, LLC (CDBS).
2) Acceptable alternative manufacturers:
a) CEMCO
b) STUDCO
4. Rigid Board Insulation product manufacturer:
a. RMAX "TSX-8500 Thermasheath-3".
1) Tape "R-Seal 3000".

b. Acceptable Alternative Manufacturers:
   1) ATLAS.
   2) JOHNS MANVILLE CORPORATION.
   3) TREMCO.

5. Fiber-Cement Board product manufacturer:
   a. SWISS PEARL.
      1) "Vintago".

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Continuous Insulation for Wall Panels:
1. ASTM C 1289 "Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board", Type 1, Class 1, isocyanurate with front and back aluminum foil-faced (balanced panel), conditioned "R" value of 5.60 per inch minimum, in accordance with ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials", and ASTM D 1621 "Test method for Compressive Properties of Rigid Cellular Plastics".
   a. Flame Spread Index Maximum, core: 25 or less.
   b. Smoke Density Developed Index Maximum, core: 450 or less.
   c. Compressive strength: 20 PSI.
   d. 4' x 4' or 4' x 8' panels.
   e. Thickness: 1".

B. Building Wrap (also qualifies as an "Air Barrier"): Woven and non-woven polyolefin sheets approved per ICC ES Reports for Water-Resistive Barriers for buildings of any construction type and equivalent to Grade D paper with 60 minute water-resistant rating.

C. Sealing Tape (3" wide minimum):
1. Minimum 3" wide tape.
2. Sealing Tape shall be compatible with Building Wrap.

D. Penetration Flashing: Self-adhered and self-healing weather barrier strips, in accordance with FS UU-B-790a, Grade A.
1. 40 mil. minimum thickness, in 9-inch and 12-inch widths as is appropriate for barrier application.

E. Support Structure:
1. Steel Sheet:
   a. Steel sheet for 16 gage and heavier shall comply with ASTM A 1003 "Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members", structural steel classification, Grade 50 ksi, Class 1 or 2.
   b. Steel sheet for 18 gage and lighter shall comply with ASTM A 1003 "Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members", structural steel classification, Grade 33 ksi, Class 1 or 2.
   c. When hot-rolled steel sheet and strip is used in fabrication of metal members they shall comply with ASTM A1011 "Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength", structural steel classification, Grade 50 ksi.
2. Coating:

a. Steel sheet shall be galvanized in accordance with ASTM A 1003 "Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members", G90 minimum and comply with ASTM A 924 "Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process".

b. When hot-rolled steel sheet and strip is used in fabrication of metal members, hot-dip galvanize coating shall be in accordance with ASTM A 123 "Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products".

3. Thickness:

Reference Gage	Mils	Minimum Base-Metal Thickness (inch)	Minimum design Thickness (inch)
20	33	0.0329	0.0346
18	43	0.0428	0.0451
16	54	0.0538	0.0566
14	68	0.0677	0.0713
12	97	0.0966	0.1017
10	118	0.1180	0.1240

F. Rigid Board Insulation:

1. Exterior:

a. In accordance with:

1) ASTM C 1289 "Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board", Type 1, Class 1, isocyanurate with front and back foil-faced (balanced panel), conditioned "R" value of 5.60 per inch minimum, in accordance with ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials", and ASTM D 1621 “Test method for Compressive Properties of Rigid Cellular Plastics”.

a) Flame Spread Index Maximum, core: 25.

b) Smoke Density Developed Index Maximum, core: 450.

c) Compressive strength: 20 PSI.

d) 4' x 4' or 4' x 8' x 1" panels.

e) Thickness: 1".

2. Tape:

a. High Strength dead soft aluminum foil coated with cold weather acrylic pressure sensitive adhesive approved as a Water-Resistive Barrier Component AC71 per ASTM E 331 and AATTCC Test Method 127.

G. Fiber-Cement Panels:

1. Exterior Panels, factory-formulated with ultra high performance concrete and reinforced with alkali-resistant (AR) glass mesh, factory-mixed and manufactured; complying with ASTM C1186. Type A, Grade IV.

2. Panel Characteristics:

a. Panel Sizes: As indicated in the Drawings .

b. Panel Dimensional Tolerances:

1) Panel Thickness: 8 mm nominally.

2) Panel Edges: Square Cut.

3) Panel Weight: 4.3 lbs/ft^2, at 8 mm thickness.

c. Panel Finishes:

1) Finish exposed, front-facing surface of UHPC as follows, to match approved design reference sample. Panel faces shall be free of joint marks, or obvious defects.

2) Finish Characteristics:

a) Texture Smooth.

3) Pattern Direction: Horizontal.

d. Panel Color:

1) Panel to be Integrally through colored.

2) "Vintago V107.

H. Accessories:

1. Adhesives and Sealants:
   a. As recommended in panel manufacturer's written instructions.
2. Stainless Steel Drill Screws: Of sufficient lengths and sizes to securely fasten support structure to building wall framing members, and as follows:
   a. Screws complying with ASTM C 1002 for fastening to steel members less than 0.033 inches thick.
   b. Screws complying with ASTM C 954 for fastening to steel members from 0.033 to 0.112 inches thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual that affects the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.
4. A weather resistant barrier is required when installing fiber-cement panels.
   a. Use an approved weather resistive barrier (WRB) as defined by the 2013 CBC.
5. Appropriate metal flashing shall be used to prevent moisture penetration around all doors, windows, wall bottoms, material transitions and penetrations.

B. Do not install panels or components that appear to be damaged or defective.

C. Do not install wet panels.

3.2 PREPARATION

A. Coordination:

1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:

1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

C. Surface preparation:

1. Prepare surface in accordance with manufacturer's instructions and recommendations.
2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

3.3 INSTALLATION

A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.

B. Installation of Water Barriers:
1. Install Water Barriers prior to installation of exterior wall, exterior soffit and exterior fascia framing.
2. Water Barriers shall be installed at all exterior walls, exterior soffits and fascias.
3. Install Water Barriers with Penetration Flashing, Metal Accessories, and all other related work in "shingle" or "weatherboard" fashion.
4. Water Barriers shall be installed as required in CBC Sections 1404.2, 1405, and 2510.6 as follows:
    a. Provide two layers of Water Barriers.
        1) One inner layer of Building Wrap (also qualifies as an "Air Barrier"):
            a) Seal all edges, laps and penetrations with a 3" wide minimum Sealing Tape as part of rainscreen system.
        2) One outer layer of Building Wrap.
    b. The Water Barrier shall be applied horizontally, with the upper layer lapped over the lower layer not less than 6 inches and free from holes and breaks.
        1) Where vertical joints occur, barrier shall be lapped not less than 6 inches.
    c. Exposure:
        1) Maximum exposure of Water Barriers shall be 30 days prior to support structure and Rigid Board installation, application or less as required by Water Barrier Manufacturer.
            a) Protect Water Barriers from the elements (both exposure to the sun and water) with a temporary 6-mil visqueen barrier or other material approved by the barrier manufacturer.

C. Installation of Penetration Flashing:
1. Apply Penetration Flashing in conjunction with Water Barriers, Support Structure and all other related work.
2. Install Penetration Flashing at all openings and penetrations at all exterior walls, exterior soffits and exterior fascias.
3. Install Penetration Flashings with Water Barriers, exterior Support Structure and all other related work in "shingle" or "weatherboard" fashion.
4. Penetration Flashings shall be installed as required in CBC Sections 1405.3 in 9" widths and continuous to 9" past all intersections around all openings, penetrations and termination to other Water Barriers of all related work.
    a. Should any penetration warrant a greater width of wall flashing, provide 12" wide flashing as required.
    b. When an object extends through the Water Barrier, return the edge of the Penetration Flashing 1" and apply to the sides of the penetrating item.
5. Objects such as electrical back-boxes, electrical speaker enclosures, penetrations created by structural members, and the like.

D. Installation of Sheet Metal Transitions:
1. Apply Sheet Metal Transitions in conjunction with Water Barriers, Penetration Flashings and all other related work.
2. Install Sheet Metal Transitions to create water tight barrier and allow drainage of water to the exterior as shown on the drawings.

3. Install Sheet Metal Transitions with Water Barriers, Penetration Flashing Sheets and all other realted work in "shingle" or "weatherboard" fashion.
4. Install all Metal Accessories in accordance with manufacturer's written instructions.
    a. All Metal Accessories shall be fully supported in accordance with CBC, secure flanges to framing.
    b. Install in 10 foot lengths wherever possible.
    c. All joints (butt, mitered, bent, continuing around corners, or changing directions) shall be cut accurately, welded, or folded, sealed, pop-riveted and sealed again, for a watertight joint.

E. Support Structure:
1. General:
    a. Complete support structure assembly to support and anchor xterior UHPC wall panels. Support structure to be anchored to building structure.
2. Layout:
    a. Lines shall be straight and true.
    b. Set plumb, level, and square.
    c. Panel layout shall be a running bond pattern.
3. Install wall reinforcements, channel cleats, clips, hangers, and other accessories required for connecting wall panels to supporting members and backup materials per project/façade engineers approved design.
    a. Horizontally-oriented attachment system support bracket/angle bracket anchored directly to building structure.
    b. Vertical Girts to be painted black.
    c. Fasteners: Corrosion-resistant stainless steel fasteners and anchors of type, size and spacing required for type of substrate and project conditions.
4. Vertical girt cold formed hat channels that fasten to horizontal "Z" furring channels.
5. Support structure is to be primed and painted black.

F. Rigid Board Insulation:
1. Install per manufacturer's written recommendations.
2. Wrap and Tape all edges as part of rain screen system.
3. Exposed side of rigid boards are to be primed with an appropriate primer and painted black.

G. Fiber-Cement Panels:
1. General:
    a. Install products in accordance with the latest written installation guidelines of the manufacturer and all applicable building codes and other laws, rules, regulations and ordinances.
    b. Review all written manufacturer installation, maintenance instructions, and other applicable documents before installation.
2. Panel Cutting:
    a. Field-cut panels and drill face-fastening anchor holes in accordance with the anel manufacturer's written directions.
    b. Do not field-modify factory-drilled concealed/undercut panel anchor holes.
    c. Special Precautions may include, but not limited to:
        1) Always cut fiber cement panels outside or in a well ventilated area. Do not cut the products in an enclosed area.
        2) Always wear safety glasses and NIOSH/OSHA approved respirator whenever cutting, drilling, sawing, sanding or abrading the products. Refer to manufacturer SDS for more information.
        3) Use a dust-reducing circular saw with a diamond-tipped or carbide-tipped blade.

4) Silica Dust Warning: Fiber cement products may contain some amounts of crystalline silica, a naturally occurring, potentially hazardous mineral when airborne in dust form. Consult product SDS or visit www.osha.gov/SLTC/silicacrystalline/index.html.

3. Vertical Control/Expansion Joints and/or Horizontal/Compression Joints may be required. Refer to written installation guide(s).
4. Provide miscellaneous reinforcement of adhered panel parts and unitized panel parts per manufacturer and installation contractor's engineer.
5. Lift wall panels and install without damage.
6. Install panels level, plumb, square, and in alignment.
7. Provide temporary supports and bracing as required to maintain position, stability, and alignment of panels until permanent connections are completed.

3.4 Erection Tolerances:

A. Erect panels to comply with the following noncumulative tolerances.
1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch.
2. Top Elevation from Nominal Top Elevation: As follows:
a. Exposed Individual Panel: Plus or minus 1/8 inch.
b. Exposed Panel Relative to Adjacent Panel: 1/8 inch.
3. Support Elevation from Nominal Elevation: As follows:
a. Maximum Low: 1/2 inch.
b. Maximum High: 1/4 inch.
4. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet: 1 inch.
5. Plumb in Any 10 Feet of Element Height: 1/4 inch.
6. Maximum Offset in Alignment of Matching Edges: 1/8 inch.
7. Face Width of Joint: As follows (governs over joint taper):
a. Panel Dimension 20 Feet or Less: Plus or minus 1/4 inch.
8. Maximum Joint Taper in 10 Feet: 1/8 inch.
9. Differential Bowing, as Erected, between Adjacent Members of Same Design: 1/8 inch.

3.5 CLEANING AND PROTECTION

A. Perform cleaning procedures according to panel manufacturer's written instructions.

B. Clean soiled surfaces with water, using soft fiber brushes and sponges, and rinse with clean water. Mild detergent may be used if water alone is not satisfactory. Power washing is permitted, if the spray is not concentrated and nozzle is not held within 5 ft. for the panel surface. Prevent damage to surfaces and staining of adjacent materials.

C. Prevent damage to surfaces and staining of adjacent material.

D. The installer is responsible for removing all metal, and scraps, clips, or fasteners along with crates and packing materials from this work, from the site when the installation is complete.

END OF SECTION

SECTION 075113 - BUILT-UP ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. General: Provide all material, labor, transportation, equipment and services necessary to completely install all cold process bituminous roofing materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
      a. Conventional Built-Up Roof System consisting of modified asphalt-based two-ply system with white coating.

B. Related Requirements: The following Sections contain requirements that relate to this Section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 04 22 00 CONCRETE MASONRY UNITS
   4. 05 30 00 METAL DECK
   5. 06 10 00 ROUGH CARPENTRY
   6. 07 21 00 INSULATION
   7. 07 40 00 METAL PANELS
   8. 07 60 00 SHEET METAL
   9. 07 72 00 ROOF ACCESSORIES
   10. 07 92 00 SEALANTS
   11. 09 11 00 METAL FRAMING
   12. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   13. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with the following standards:
      a. FMG Factory Mutual for FMG 1A-90 wind uplift requirements.
      b. NIST BSS #55, Building Series #55: Preliminary performance criteria of Bituminous Membrane Roofing, National Institute of Standards and Technology, Gaithersburg, MD.
      c. NRCA National Roofing Contractor's Association (NRCA).
      d. SMACNA Sheet Metal and Air Conditioning Contractors National Association, Vienna, VA.
      e. UL Underwriter's Laboratory (UL) test certification labels or equivalent testing agency with same follow-up testing and certified label program must be displayed on related roof assembly materials.
      f. UL 790 Underwriter's Laboratory, certified roof assembly to roof type identified on the drawings.

1.3 SYSTEM DESCRIPTION

A. General
   1. Performance Requirements:
      a. Fire Rating: UL Class A.

b. Wind Uplift: FMG IA-90 .

2. Typical system components for all roofing types:
   a. Flashings and Flashing Accessories.
   b. Reflective Surfacing over Cap Sheet.
   c. KEE membrane at parapets over 48" in height.

B. Typical metal deck roof system for this project:
1. Metal deck.
2. Vapor Retarder.
3. Rigid Board (Isocyanurate Board), mechanically attached.
4. Cover Board (Fiberboard).
5. Two (2) ply bituminous roofing system, cold process.
6. Mineral Surfaced Cap Sheet.

C. The extent of cold process bituminous roofing system work is indicated by provisions of this section, and is defined to include roofing, insulation immediately under the roofing systems, elastomeric flashings, stripping, walkpads, and roofing accessories integrally related to roofing installation with all compatible with manufacturer's warranty requirements.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
1. Coordination Drawings:
   a. Submit installer's coordination drawings indicating the work of this section coordinates with that of related sections for proper interface of the completed work. Installer shall coordinate and obtain approvals of other related sections prior to submitting to the Architect.
   b. Submit one-way roof vent location plans to the Architect for approval that has been approved by the roofing manufacturer as to location in conjunction with all proposed roof penetrations.
2. Product Data.
   a. Submit manufacturer's product data including performance requirements of all materials.
   b. Material Safety Data Sheets will not be reviewed, but if submitted will be turned over to the Owner in compliance with local rules and regulations.
3. Shop Drawings.
   a. The Roofing Contractor, in concert with the Material Manufacturer, is to submit detailed drawings of all flashing and roofing system details compatible with the manufacturer's requirements for the roofing system warranties, required herein for review and approval, prior to start of roof framing by the General Contractor.
4. Quality Assurance/Control Submittals:
   a. Certificates:
      1) Submit three (3) copies of certification from a Corporate Officer of the Roofing Material Manufacturer stating that major roofing system components including insulation, flashing, coatings, cold process adhesives; roofing ply sheets; reinforcement fabrics, felts, walkpads, mastics, and sealants are compatible with all the other components of the roofing system and the warranties required herein, for single source liability.
      2) Submit three (3) copies of certification from Roofing Material Manufacturer that cold process coatings and adhesives are not "Red Label".
      3) Submit three (3) copies of certification from Underwriter's Laboratory (or approved equivalent prior to submittal) that the roofing systems meet or exceed listed performance requirements listed herein.

4) Submit three (3) copies of certification from an independent laboratory showing test results (utilizing the ASTM testing criteria listed herein) for all roofing materials and completed assemblies, indicating compliance with the performance requirements listed herein.

b. Manufacturer's Written Instructions:

1) Submit three (3) copies of certification from an independent laboratory showing test results (utilizing the ASTM testing criteria listed herein) for all roofing materials and completed assemblies, indicating compliance with the performance requirements listed herein.

c. Manufacturer's Field Reports:

1) Submit three (3) copies of manufacturer's field reports for each roofing system type indicated (i.e. those appropriate for metal decks or wood decks) indicating the final status of the installed roofing systems over various roof decking systems, and that they are in compliance with the manufacturers warranty requirements.

5. Closeout Submittals in accordance with Specification Sections in Division One:

a. Project Record Documents in accordance with Specification Section - PROJECT RECORD DOCUMENTS.

b. Warranty in accordance with Specification Section - WARRANTIES.

1) Special warranties:

a) Five (5) Year Workmanship Warranty.

b) Twenty (20) Year Major Manufacturer’s Roofing System Warranty.

1.5 QUALITY ASSURANCE

A. General Requirements:

1. The Roofing Contractor shall ensure that all products used in conjunction with the installation of the new roofing system(s) are totally free of asbestos. Products containing asbestos are prohibited on this project.
2. Deliver all roof system materials in original manufacturer labeled packages. All roofing products delivered to the site and used on this project will bear Class A Fire Rating Labels.
3. All adhesives and cements shall be compliant with current applicable VOC Requirements State and Local on the project. Contractor shall use products with personal protection when applicable. The Roofing Contractor shall insure that all product users read container labels and MSDS information prior to use.

B. Only those manufacturers who produce, label and warrant all major and/or primary components of the specified roofing system, can exhibit $10,000,000.00 product liability, or a $2,000,000.00 product liability policy with a $5,000,000.00 umbrella per event insurance coverage and comply with all other requirements of this Specification.

C. The products listed herein establish the size, weight, pattern, color range and function selected by the Architect for this Project. The intent is not to limit competition, but to utilize only those products which have been employed previously on projects of a similar nature and found acceptable.

D. Qualifications:

1. Material Qualifications:

a. Roofing Material Manufacturer shall:

1) Be nationally recognized in roofing and waterproofing industry for at least ten (10) years.

2) Provide local Field Representative to make periodic site visits, report work quality and job progress.

3) Provide list of at least three (3) projects available for inspection employing same system(s) within the last three years, within the same climate zone and 75 mile distance of project building(s).
4) Be approved by Owner and the Architect.
5) Provide Owner and the Architect proof/copy of material product liability insurance for all materials in an amount not less than $10,000,000.00, or a $2,000,000.00 product liability policy with a $5,000,000.00 umbrella per event.
6) Provide Owner and the Architect certified independent laboratory test results for all roofing materials using ASTM test criteria as designated in Part 2 - Product section of this Specification indicating compliance with the performance criteria contained herein.
7) The presence and activity of the manufacturer's representative and/or Owner's representative shall in no way relieve the roofing contractor of his/her contractual liabilities/responsibilities.
8) Provide to the Owner names of at least three (3) qualified roofing applicators/installers.

2. Installer Qualifications:
   a. The Roofing Contractor shall be experienced and certified in writing by the Roofing Material Manufacturer to install manufacturer's products and systems in accordance with manufacturer's warranty requirements.
   b. The Roofing Contractor and his/her installers shall:
      1) The Roofing Contractor shall be experienced and certified in writing by the Roofing Material Manufacturer to install manufacturer's products and systems in accordance with manufacturer's warranty requirements.
      2) Be acceptable to the Owner, Architect and Roofing Material Manufacturer.
      3) Provide list of at least three (3) projects available for inspection employing specified system(s) within the last three years, within the same climate zone and within 75 miles distance of project building(s).
      4) Be responsible for obtaining all data required from Roofing Material Manufacturer.
      5) Obtain and provide all required data from Roofing Material Manufacturer.
         a) These specifications are based on minimum performance requirements of both the Roofing Contractor and Roofing Material Manufacturer.

E. Regulatory Requirements:
   1. In accordance with Specification Section - Regulatory Requirements, and the following:
      a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB)and the Environmental Protection Agency (EPA), in the area where the project is located.

F. Meetings:
   1. Pre-installation: Scheduled by the Contractor prior to the start of work.
      a. Coordinate the work with all other related work.
      b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
   2. Progress Meetings: Scheduled by the Contractor during the performance of the work.
      a. Review for proper installation of work progress.
      b. Identify any installation problems and acceptable corrective measures.
      c. Identify any measures to maintain or regain project schedule of necessary.
   3. Completion: Scheduled by the Contractor upon proper completion of the work.
      a. Inspect and identify any problems that may impede issuance of warranties or guaranties.

b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.
2. Handle materials to avoid bending, tearing, or other damage during transportation and installation.
3. Material handling equipment shall be selected and operated so as not to damage existing construction or applied roofing.
   a. Do not operate or situate material handling equipment in locations that will hinder smooth flow of vehicular or pedestrian traffic.

B. Acceptance at Site:
1. Coordinate delivery with Contractor.
2. Products delivered to the job-site must be in manufacturer's original, new, dry and unopened containers with labels indicating brand name, grade and ASTM number.
3. Deliver materials in sufficient quantity to allow continuity of work.
4. Damaged products will not be accepted.

C. Storage and protection:
1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
   a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.
   b. Store roll goods on ends only and protect from moisture contamination of any kind.
   c. Discard rolls and insulation which have flattened, creased, allowed to become damp/wet, or otherwise damaged.
   d. Place and store materials on pallets.
   e. Do not stack pallets.
2. Store materials marked "keep from freezing" in areas where temperatures will remain above 40 degrees Fahrenheit.
3. Neatly stack products on dunnage.
4. Remove breathable waterproof covering. Cover top and sides of all stored materials at interior and exterior storage areas with canvas tarpaulin or equivalent cover to allow the materials to "breathe".
   a. Secure cover.
   b. Do not use polyethylene to cover materials.
5. Rooftop Storage: Disperse material to avoid concentrated loading. Any damage to the structure resulting from non-conformance to this requirement will be the sole responsibility of the roofing contractor.
6. Materials necessary for two day's work may be stockpiled on roof under the provisions outlined in paragraph 5 above.
7. No materials may be stored in opening or in contact with ground or roof/deck surface.
8. The Roofing Contractor shall assume full responsibility for the protection and safekeeping of roofing materials and products stored on the job-site premises.

1.7 PROJECT CONDITIONS

A. Environmental requirements:
1. Do not work in rain, snow, or in presence of moisture, including dew or fog.

2. Do not work in temperatures at or below 40 deg. F.
3. Do not install materials marked "keep from freezing" in areas where temperatures will remain below 40 deg. F.
4. Remove any work exposed to freezing and replace with new.

1.8 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. Roofing Contractor and Roofing Materials Manufacturer’s Guarantee:
      a. Upon project completion and Roofing Material Manufacturer's acceptance of the completed roofing system, the roofing contractor shall deliver to the Owner a Major Manufacturer's Roofing System Guarantee, covering labor and materials, and shall guarantee to repair or replace defective materials including labor and installation on a pro-rated basis.
         1) Warranty period Twenty (20) Years.
         2) The Roofing Material Manufacturer shall provide re-inspection of roofing system, including all integral components, at two (2) year and five (5) year anniversaries, and provide the Owner written summary of roof system analysis.
            a) Provide housekeeping and preventative maintenance at the 2nd and 5th year site visits.
         3) Written guaranties or warranties will include all integral components of entire roofing assembly including: Insulation, roof membrane, flashings, termination details, metal components and surfacing materials.

C. Installers Warranty:
   1. Roofing Contractor’s Workmanship and Materials Warranty:
      a. Upon project completion and acceptance, the subcontractor shall issue Owner a warranty against defective workmanship and materials.
      b. The roofing contractor shall warranty to maintain the roof and flashing in a watertight condition for the period of years specified from the date of acceptance and shall be responsible for the repair of any failure that is the result of defects in materials and workmanship.
         1) Warranty Period Five (5) years.
      c. The roofing contractor shall obtain from the Roofing Material Manufacturer and the General Contractor a co-endorsement of the Warranty.

1.9 MAINTENANCE

A. Maintenance Service:
   1. Continuing Maintenance Agreement: Provide a continuing maintenance proposal from Installer to Owner with terms, conditions, and obligations as set forth in, and in the same form as, “Draft of Roof Maintenance Agreement” at end of this Section, starting on the date established for Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
   1. Specified product manufacturer:
      a. THE GARLAND COMPANY, INC.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Insulation Materials:
   1. Cover Board:
      a. Fiberboard: Regular density, asphalt impregnated on two sides, in accordance with ASTM C 208 "Specification for Cellulosic Fiber Insulating Board".
   2. Cricket Board:
      a. Isocyanurate Insulation Board: FS HH-1-1972/2(1), Type II, Class 1, isocyanurate with surface fiber/organic mat facers on both sides, conditioned "R" value of 5.70 per inch.
      b. Flame Spread and Smoke Developed in accordance with ASTM E84 "Test method for Surface Burning Characteristics of Building Materials":
         1) Flame Spread Index: 25 - 60.
         2) Smoke Density Developed Index: 75 – 160 range.
   3. Insulation Board Sizes:
      a. Rigid Board: 4' x 8' x 5"- two layers of 2.6"- or thickness as indicated on the drawings (minimum thickness as required for a Class A Roof System), and as indicated on the drawings for roof slope.
         1) Cricket Board: 2' x 4' dimension minimum, tapered thicknesses, slope as indicated
      b. Cover Board: 4' x 8' x 1/2 inch minimum thickness (or as required for a Class A roof system).
   4. Cant Strip:
      a. Fiberboard, in accordance with ASTM C 208 "Specification for Cellulosic Fiber Insulating Board". Length: Forty-eight (48) inches.
         1) Minimum thickness: Three (3) inches nominal, face 4 inches nominal.
   5. Insulation adhesive:
      a. ASTM D 312 "Specification for Asphalt Used in Roofing", Type IV asphalt.

B. Vapor Retarders:
   1. RP Vapor Retarder (Reinforced-Polyethylene Vapor Retarders): 2 outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb/1000 sq. ft., with maximum permeance rating of 0.0507 perm.

C. Mechanical Fasteners:

1. Provide industry-standard, non-corrosive types of mechanical fasteners (i.e.: screws and plates, termination bars, drawbands) for cold process built-up roofing system work, tested by manufacturer for required pull-out strength where applicable and compatible with substrate type, roofing products used and warranties required. Size of fasteners and plates shall be as recommended by roofing manufacturer in accordance with manufacturer's warranty requirements, and sufficient to comply with FMG 1-60 wind uplift requirements.

D. Roofing Materials:
1. Roof Cement: Fibrated asphalt mastic meeting or exceeding ASTM D 4586 "Specification for Asphalt Roof Cement, Asbestos-Free".
2. Primer for all sheet metal and concrete surfaces:
   a. Quick drying, asphaltic primer meeting or exceeding ASTM D 41 "Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing" and complying with CARB requirements.
3. Interply Adhesive Cold Adhesive
4. Interply Felt:
   a. Nonperforated, SBS Modified, asphalt-coated, fiberglass reinforced sheet dusted with fine mineral surfacing on both sides that meets the requirements of ASTM D 5147 "Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material".
5. Flashing Sheet and Wall Flashing: Fiberglass Reinforced SBS Modified Membrane.
6. Wall Flashing at parapets over 48":
   a. Fully adhered 60 mil reinforced KEE membrane that is fully approved, warranted, and in accordance with modified membrane manufacturer.
7. Flashing Adhesive: Asphalt Mastic.
8. Reinforcement Webbing: Vinyl-Coated Fiberglass Webbing.
9. Stripping Ply: Refer to Interply Felt.
10. Cap Sheet Granule Surfaced SBS(-SIS) Modified Membrane.
    a. ASTM D 6163 "Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements", Grade G, Type I, glass-fiber-reinforced, SBS Modified Asphalt Sheet, Granular Surfaced.
11. Reflective Surfacing Coating. Acrylic Reflective Coating per CRRC for a "Cool Roof".
12. Caulking:
    a. Single component, non-sag, epoxidized polyurethane sealant, per Federal Specification TT-S-00230C.
13. Walkpads:
    a. As recommended by manufacturer in accordance with manufacturer's warranty requirements, Class A material, and sufficient to comply with FMG 1-60 wind uplift requirements.
    b. Size as indicated on the drawings, in patterns and routes sufficient to protect adjacent roof areas from damage during anticipated maintenance of roof mounted equipment.

2.3 SOURCE QUALITY CONTROL

A. Cold Process Interply Adhesive - "Weatherking Plus WC":

	Property	Typical Value	Test Method
2.	Asbestos content	None	ASTM D 276-87
3.	Viscosity @ 25 deg. C.	800-1200 grams	ASTM D 2196-86
4.	Density @ 25 deg. C.	9 lb/gal.	ASTM D 1475-90
5.	Nonvolatile Matter	78%	ASTM D 4479-93
6.	Asphalt content, min	42%	ASTM D 4479-93
7.	Flash Point	> 100 deg. F	ASTM D 93-94

8.	Uniformly & consistency	Pass	ASTM D 4479-93

B. Base Ply/Stripping Plies: "StressBase 80":

	Property	Typical Value	Test Method
2.	Tensile Strength	100 lbf/in MD; 100 lbf/in XD	ASTM D 5147
3.	Thickness	0.080 inch	ASTM D 146-90
4.	Weight	80.0 lb/100 sf	ASTM D 228-90a

C. Cap Sheet - Fiberglass Reinforced Granule Surfaced SBS-SIS Modified Membrane: "StressPly Plus/ Plus FR":

	Property	Typical Value	Test Method
2.	Thickness	.155 in.	ASTM D 5147-95
3.	Tensile Strength	310 lbf/in MD; 310 lbf/in XMD	ASTM D 5147-95

D. Flashing Sheet -- Polyester Reinforced Granule Surface SBS Modified Membrane - "Stressply Plus FR Mineral":

	Property	Typical Value	Test Method
2.	Thickness	.155 in.	ASTM D 5147-91
3.	Tensile Strength	310 lbf/in MD; 310 lbf/in XMD	ASTM D 5147-91
4.	Elongation	3.5% MD; 3.5% XMD	ASTM D 5147-91
5.	Tear Strength	500 lbf MD; 500 lbf XMD	ASTM D 5147-91ow Temp.

E. Reflective Surfacing: "Pyramic"
1. White Elastomeric Coating.
2. Reflectance: 84%, min 5-year.
3. Energy Star compliant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual which affect the execution of work under this specification section. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
2. Prior to installation of roofing, the Roofing Contractor shall inspect the new deck conditions and verify that the new roof system may be installed in strict accordance with original design, the manufacturer's current recommendations, and all other pertinent codes and regulations.
3. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
4. Execution of work under this specification section shall constitute acceptance of existing conditions.
5. Check projections, curbs, and deck for inadequate anchorage, foreign material, moisture, or unevenness that would prevent quality and execution of the new roofing system.

B. General quality of work:
1. Substrate Free of foreign particles prior to laying roof membrane.
2. Phased application:
   a. Not permitted.
   b. All plies shall be completed each day.

3.2 PREPARATION

A. Coordination:
1. Coordinate work under this specification section with work specified under other specification sections to ensure proper and adequate interface of work.

B. Protection:
1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
2. Roofing Contractor shall be responsible for protection of property during course of work.
   a. Lawns, shrubbery, paved areas, and building shall be protected from damage.
   b. Repair damage at no extra cost to Owner.
3. Provide at site prior to commencing removal of debris, a dumpster or dump truck to be located adjacent to building where directed by General Contractor.
4. Roofing, flashing, membrane repairs, and insulation shall be installed and sealed in a watertight manner on same day of installation or before arrival of inclement weather.
5. At start of each work day drains within daily work area shall be plugged.
   a. Plugs to be removed at end of each work day.
6. Preparation work shall be limited to those areas that can be covered with installed roofing material on same day.
7. Arrange work sequence to avoid use of newly constructed roofing for storage, walking surface, and equipment movement.
8. At end of each working day, completed segment shall be sealed with water stops along edges to prevent water infiltration. Refer to INSTALLATION for specific instruction.
9. Provide clean plywood walkways and take other precautions required to prevent tracking of debris into new membrane area where debris pieces can be trapped within new roofing membrane.
   a. Contractor shall instruct and police his/her workers to ensure that debris is not tracked into or allowed to be wind driven into the new membrane.
   b. Discovery of entrapped debris or other foreign matter within new membrane is sufficient cause for rejection of the membrane.

3.3 INSTALLATION

A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.

B. Insulation Installation:
1. General: All insulation will extend over horizontal surfaces, including parapet braces, until the insulation boards meet the vertical parapet wall surfaces.
   a. Flush all insulation board surfaces that meet adjacent surfaces to be free from any uneven or gapped joints, sharp edges or other irregularities.
2. Metal Deck:
   a. Loose lay RP Vapor Retarder and seal all laps.
   b. Mechanically attach bottom layer of Rigid Board thermal or roof slope insulation to the top plate over metal deck at low flute.
      1) Mechanical fasteners are not to be exposed from under deck.
      2) Fastener density:
         a) Perimeter 16 fasteners per 4’ x 8’ insulation board.
         b) Field 12 fasteners per every 4’ x 8’ insulation board.
      3) Install additional fasteners to ensure insulation is firm under foot.

4) Stagger joints at least six (6) inches.
5) Drive mechanical fasteners flush to top surface.
6) Filler insulation requires two (2) fasteners per piece minimum.
7) Bottom layer shall form continuous insulation joints over deck flange.
a) Do not cantilever insulation edges over deck ribs.
b) Minimum bearing surface 1-1/2 inches.

c. Hot mop attach cover board insulation to bottom layer.
1) Hot asphalt application rate shall be 25 lbs per 100 square feet.

d. Hot mop attach the second layer of Rigid Board thermal insulation to the first layer of Rigid Board thermal or roof slope insulation.
1) Hot asphalt application rate shall be twenty-five (25) lbs. per 100 sq. ft.

e. Hot mop attach Cover Board insulation to bottom layer.
1) Hot asphalt application rate shall be twenty-five (25) lbs. per 100 sq. ft.

C. Flashing:
1. General Flashing Specifications:
a. All other flashings not specifically detailed herein will be applied in accordance with manufacturer's written recommendations and approved by the Architect.
b. All sheet metal that will come in contact with bituminous materials shall be primed with the specified asphaltic primer and allowed to dry before applying bitumen.
c. The top edge of all base flashing and base flashing laps shall be three-coursed.

D. Wall Flashing:
1. SBS Modified Wall Flashing Installation:
a. Roofing Contractor shall install base flashing at the base of all existing vertical wall and curb surfaces in the following manner:
1) All flashing must be temporarily sealed at the end of each working day.
2) Refer to manufacturers recommended installation procedures and the system performance requirement for proper installation of perimeter flashings.
3) All Wall Flashings will receive a backer sheet utilizing the ply/base sheet.
4) Wall Flashing shall extend from the top of the parapet and down the inside face of the wall. Embed the SBS Modified flashing sheet in a continuous application of flashing mastic per the manufacturer's current written recommendations.
5) Secure the top edge of the base using a galvanized metal termination bar. Fasten the termination bar to concrete walls using concrete screws turned into pre-drilled holes at 8 inches on center. Fasten the termination bar to plywood walls using screws at 8 inches on center.
6) The flashing sheet shall extend to the outside edge of all raised edge nailers.

E. Roofing Contractor shall install roof drain flashings as follows:
1. Drain rings shall be removed prior to built-up roofing application.
2. A minimum 3 foot square lead flashing sheet shall be set into a solid coating of asphaltic mastic over the installed roofing plies. Install a one (1) ply stripping using specified base sheet. First ply shall be embedded in a asphaltic mastic and shall cover the lead completely and extend onto the field of the roof 6" in all directions. All plies, including the lead flashing and field plies must extend into the drain and under the clamping ring.
3. The drain ring shall be set into asphaltic mastic and immediately tightened. A guard screen shall be installed over all drains.
4. After complete installation of the roofing system, Roofing Contractor shall inspect and test all roof drains to assure that no clogging of the drainage system is present. The roof drain leader should be in such condition that full diameter of the drain leader is clear.

F. Roofing Contractor shall tie onto all flanged metal components in the following manner:

1. Prime all metal that is to come into contact with asphaltic compounds with specified primer.
2. All flanges shall be set into asphaltic mastic over the finished roofing plies. Galvanized metal flanges will be fastened to the underlying wood nailers at three (3) inches on. center, staggered.
3. All flanges, including pipe flashing, edge flashing, flanged vents, flanged units, pitch pans, etc., will be flashed on the roof with two plies of stripping ply sheet. Install a one (1) ply stripping using specified base sheet. First ply shall be embedded in a asphaltic mastic and shall cover the lead completely and extend onto the field of the roof 6" in all directions.

G. Contractor shall install all edge metal in the following manner:
1. Set edge metal into layer of asphaltic mastic over finished field plies.
2. Install metal cleats. Cleats shall be at least one gage heavier than the metal edge.
3. Metal sections shall be a maximum of ten (10) feet in length. Leave a minimum of 1/2" space between metal sections. Install a minimum of 4" wide lap over and nail in place through 1/2" gap in metal sections. Nail metal edge 3" o.c. staggered.

H. Install one ply of stripping ply sheet to metal flange and roof surface. Roofing system application:
1. Install one (1) pliy of specified composite reinforced roofing felts over the cover board and the roof deck system, set into solid spray applications of cold-process asphalt in the following manner:
   a. Starting at the low point of the roof, apply one 4 inch side strip, and then over starter strip, apply a full 36 inch wide specified roofing felt. Following plies are to be applied full width, overlapping the preceding felt by 4 inches .
   b. Cut 12 to 18 foot lengths of specified felt, allow to relax thirty (30) minutes at 55 deg. F+ or sixty (60) minutes at 55 deg. F-. Flop shingle fashion into a full width application of cold-process asphalt applied at a nominal rate of 2.0 gallons per 100 square feet. The specified felt must be firmly and uniformly set into the asphalt with all edges well sealed.
   c. Lightly broom and/or roll each ply of specified felt into place, full width, immediately after installation. Felts shall lay flat and be fully bonded in such a manner that in no area shall felt touch felt. Use only a squeegee or conduit type broom.
   d. Apply uniform and continuous pressure to exposed edge and end laps to ensure complete adhesion.
   e. Lap ply ends 6 inches. Stagger end laps 3 feet minimum.
   f. Header laps in roof field shall be at least 2 feet.
   g. Overlap previous day's work 18 inches.
   h. Cut out and patch all fishmouths and side laps which are not completely sealed. Replace all sheets which are not fully and continuously bonded.
   i. Roof surface will be rolled after each work day to smooth fishmouths.

I. Contractor shall adhere to the following guidelines:
1. Roofing materials shall not be installed during inclement weather. Roofing materials shall not be applied when moisture in any form, such as dew, can be seen or felt on the surface to which those materials are to be applied.
2. Valleys and waterways shall receive an additional ply of fiberglass felt which shall be at least 36 inches wide. This ply shall be laid on top of the insulation prior to the application of the other plies and shall extend at least 18 inches up the inclines, out of the valleys.
3. Interply applications of cold-process asphalt shall be continuous and applied at a nominal rate of 2.0 gallons per 100 square feet. Application methods shall insure that all plies are completely embedded in asphalt.

4. All exposed deck and insulation must be covered with the completed roof membrane system, at the end of each day's work. All roof terminations and openings shall be water sealed.
5. Staging of the roof membrane application or temporary membrane is not acceptable. Membrane shall be installed in final form, with the exception of the cap sheet, on a daily basis.
    a. If phased roofing occurs, following prior approval of the Architect, as a result of emergency conditions, install additional plies over phased areas so that a continuous three (3) ply system is installed.
6. Foot and wheeled traffic shall be kept off the newly installed membrane until asphalt has sufficiently cured to prevent displacement voids.
7. All membrane deficiencies such as voids, bridging, fishmouths, cuts, tears, etc., shall be repaired in an acceptable manner. Incorporate into such repairs as many plies as are affected by the deficiency.
8. Air void pockets, as determined by test samples, shall not exceed eight percent per interply mopping for individual sample and average of all samples shall be not less than five percent per interply adhesive. If corrective action is required, cut the roofing felts down to the void and cover with three plies of fiberglass felt set into cold-process asphalt applied at a nominal rate of 3 gallons per 100 square feet.

J. Walkpad Installation:
1. After roof coating has been applied and cured, install walkpad panels in a path 3 feet wide around all HVAC mechanical units requiring regular maintenance (coordinate with mechanical contractor for items requiring maintenance). Space between pads no greater than 6 inches, and no less than 4 inches.
2. Adhere to roofing in a spot application of asphalt mastic.

3.4 APPLICATION

A. Cap Sheet: Install lapped granulated cap sheet starting at low point of roofing system. Offset laps from laps of preceding ply sheets and align cap sheet without stretching. Lap in direction to shed water. Extend cap sheet over and terminate beyond cants.
1. Embed cap sheet in a solid application of cold fluid-applied adhesive applied at rate required by roofing system manufacturer.

B. Apply White Surfacing over completed cap sheet and flashings in the following manner:
1. Remove all dirt, dust, and other loose debris from the roof. Area to be coated must be a clean, sound, and dry surface.
2. Prime roof surface prior to application of reflective coating at a rate of 200-400 sq ft. /gal.
3. Refer to manufacturer’s installation procedures and apply at a minimum of 3 gal./SQ.

3.5 REPAIR / RESTORATION

A. Repair of deficiencies:
1. Installations of details noted as deficient during Final inspection must be repaired and corrected by the Roofing Contractor and made ready for re-inspection, within five (5) working days of notification.

3.6 FIELD QUALITY CONTROL

A. Inspection:

1. Schedule inspections and notify the Architect, Owner's Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.

B. Manufacturer's field services:
1. Provide the services of a factory-authorized service representative to supervise the field assembly of components and installation of products or systems and related connections specified within this section, with weekly reports of the results in writing to the Architect.

3.7 CLEANING

A. Clean in accordance with Specification Section – PROJECT CLOSEOUT.
1. Clean any soiled surfaces at the end of each day, minimum.
2. Finish shall be clean and ready for the application of any additional finishes.

3.8 PROTECTION

A. Protection from weather:
1. Protect newly installed work from freezing for 24 hours after erection, installation or application.

B. Protection from traffic:
1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

3.9 SCHEDULES / FORMS:

A. ROOFING SYSTEM MANUFACTURER'S CONTINUING MAINTENANCE AGREEMENT
1. WHEREAS _____ of _____, herein called the "Manufacturer," has supplied roofing membrane and associated materials and approved all other related materials ("materials") on the following project:
   a. Owner:_____
   b. Address:_____
   c. Building Name/Type:_____
   d. Address:_____
   e. Area of Work:_____
   f. Acceptance Date:_____
   g. Warranty Period: 10 years from date of Substantial Completion.
   h. Expiration Date:_____
   i. Roofing Installer:_____
   j. Contractor:_____
2. MANUFACTURER agrees to provide Roofing System Continuing Management and Maintenance services to the Owner, on a bi-annual basis, for a period of 10 years, performed under direction of Manufacturer's Authorized Service Representative, as described below:
   a. Roof Inspection Report: Provide roof inspection and report of roof conditions based upon roof inspections.
   b. Special Post-Storm Roof Inspection Report: Roof inspection at Owner request following major storm activity.

c. Roof Housekeeping: Inspect roof membrane, drains, gutters, and scuppers. Remove, bag and properly dispose of all debris.

d. Roof Membrane Preventive Maintenance and Repair: Repair tears, splits and breaks in the roof membrane with appropriate repair mastic and membranes in accordance with Membrane Manufacturer's written repair and maintenance guidelines. Dress up reflective coatings on flashings. Coat all exposed reinforcing membranes with approved mastics.

e. Roof Flashing Preventive Maintenance:

1) Metal Edge and Flashing Components: Repair tears, splits, and breaks in membrane flashings and open flashing strip-ins with appropriate repair mastics and membranes. Secure loose metal edge cleats and clips. Tighten and reseal exposed fasteners.

2) Parapet, Wall, and Counterflashing Systems: Repair tears, splits, and breaks in metal flashings and open flashing strip-ins with appropriate repair mastics and membranes. Coat all exposed reinforcing membranes with approved mastics. Tighten and reseal exposed fasteners. Clean and seal voids in termination bars, counterflashings and parapet caps. Secure loose termination bars and counterflashings. Check and re-secure loose metal coping caps.

3) Equipment/Projection Flashing Components: Repair tears, splits, and breaks in metal flashings and open flashing strip-ins with appropriate repair mastics and membranes. Secure unsecured roof top equipment. Tighten and reseal exposed fasteners. Clean and seal voids in termination bars. Refill pitch pans. Check and reseal metal projections (hoods and clamps).

f. Drainage Systems Preventive Maintenance: Check and re-secure drain bolts and clamping rings. Advise owner of missing drain dome strainers. Check strip-ins around drain leads and coat with approved mastic. Check gutter straps, joints and strip-ins. Check inside and exterior of scuppers for open solder or caulking seals.

g. Roof Systems Leak Response:

1) In the event of a roof system leak, Manufacturer shall provide to Owner:

a) Toll free 800 number for Owner for leak report, monitored twenty-four hours per day, 365 days a year.

b) Response to Owner on all leak calls within twenty-four hours.

c) Qualified repair crew at the building site within two business days of call.

d) Follow-up inspection by Manufacturer's Authorized Service Representative with written report to Owner.

e) Written summary of leak events, repairs, and inspections to Owner at end of each quarter in which leaks have occurred.

h. Roofing System Continuing Management and Maintenance Services repair coverage exclude such damage to the roof system excluded from the Manufacturer's Warranty as a result of negligence, vandalism, or other excluded cause as described in manufacturer's published terms and conditions at the original date of this Contract.

3. MANUFACTURER agrees to provide the above-described services for the time period indicated for [the lump sum of][the annual fee of]_____ and no/dollars ($_____).

4. SUBMITTED this _____day of _____, 20____.

a. Authorized Signature:_____

b. Name:_____

c. Title:_____

d. Manufacturer:_____

e. Address:_____

f. Telephone number:_____

END OF SECTION

SECTION 07 60 00– SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all Sheet Metal materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 04 22 00 CONCRETE MASONRY UNITS
4. 05 12 00 STEEL AND FABRICATIONS
5. 05 30 00 METAL DECK
6. 06 10 00 ROUGH CARPENTRY
7. 06 41 23 MODULAR CASEWORK
8. 07 14 16 FLUID-APPLIED WATERPROOFING
9. 07 21 00 INSULATION
10. 07 40 00 METAL PANELS
11. 07 51 13 BUILT-UP ROOFING
12. 07 72 00 ROOF ACCESSORIES
13. 07 92 00 SEALANTS
14. 08 11 00 METAL DOORS AND FRAMES
15. 08 14 16 WOOD DOORS
16. 09 22 00 METAL FRAMING
17. 09 24 00 CEMENT PLASTER
18. 09 91 00 PAINTING
19. 10 05 00 MISCELLANEOUS SPECIALTIES
20. 11 40 00 FOOD SERVICE EQUIPMENT
21. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:

1. DOD Department of Defense
2. LIA Lead Industries Association.
3. NRCA National Roofing Contractors Association
4. SMACNA Sheet Metal and Air Conditioning Contractor's National Association, 6th Edition, Architectural Sheet Metal Manual.
5. SSPC The Society of Protective Coatings

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Shop Drawings.
   a. Submit shop drawings showing fabrication and installation of the work of this section including plans, elevations, sections, details of components, and attachments to other units of work.
2. Closeout Submittals in accordance with Specification Sections in Division One:
   a. Warranty in accordance with Specification Section - WARRANTIES.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Material Qualifications:
   a. Work shall be in accordance with Standards and details set forth in latest edition of the SMACNA Manual and Specifications unless indicated otherwise.
   b. The roofing manufacturer and installer selected for this project will select the roof flashing material and detailing for all roof penetrations compatible with the roofing system used and the warranties required. The schedule for roofing penetrations at the end of this section and the details contained within the drawings are minimum standards required for this project.
2. Installer Qualifications:
   a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.

B. Regulatory Requirements: In accordance with Specification Section - REGULATORY REQUIREMENTS.

1.5 PROJECT CONDITIONS

A. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

1.6 WARRANTY

A. Contractor's General Warranty: In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty: In accordance with Specification Section - WARRANTIES.

1. Warranty Period Five (5) Years.

C. Installer's Warranty:

1. Workmanship and Materials Warranty:
   a. Warranty Period Five (5) years.
   b. Upon project completion and acceptance, the subcontractor shall issue Owner a warranty against defective workmanship and materials.
   c. The subcontractor shall warranty to maintain the roof flashing in a watertight condition for the period of years specified from the date of acceptance and shall be responsible for the repair of any failure that is the result of defects in materials and workmanship.
   d. The subcontractor shall obtain from the Roofing Installer and the General Contractor a co-endorsement of the Warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified product manufacturer:
    a. Ice and Water Shield:
        1) GRACE CONSTRUCTION PRODUCTS
            a) ICE and WATER SHIELD HT.
        2) Acceptable alternative manufacturers:
            a) CARLISLE COATINGS & WATERPROOFING - CCW WIP 400.
    b. Penetration Flashing:
        1) GRACE CONSTRUCTION PRODUCTS "VYCOR V40."
        2) Acceptable Alternative Manufacturer:
            a) FORT-I-FIBER "Fort-I-Flash 40."
            b) TYVEK "FlexWrap" and "Straight Flash."
    c. Reglets:
        1) FRY REGLET CORPORATION.
    d. Primer Paint:
        1) DEVOE COATINGS PAINT.
    e. Galvanized Repair Paint:
        1) RECTORSEAL.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Sheet Metals:

1. Steel Sheet:
    a. Zinc-Coated, Commercial quality with 0.20 percent copper, ASTM A 653 "Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) by the Hot-Dip Process," G-90 hot-dip galvanized, mill phosphatized where indicated for painting; 0.0359 inch thick (20 gauge) minimum, except as otherwise indicated.
2. Lead Sheet:
    a. ASTM B 749 "Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products," Type L51121, copper-bearing sheet lead, minimum 4 lb/sq. ft. (0.0625 inch thick) minimum for burning (welding) unless otherwise indicated.
3. Aluminum Sheet:
    a. Provide sheet aluminum in accordance with ASTM B 209 "Specification for Aluminum and Aluminum-Alloy Sheet and Plate," alloy 3003, temper H14, AA-C22A41 clear anodized finish.
        1) Gauge: 0.063 inches.
        2) Prepare anodized finish for application of primer and finish coats as indicated on the drawings.
4. Stainless-Steel Sheet:

a. ASTM A 167 "Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip," Type 304, soft annealed, with No. 4 finish, except where harder temper is required for forming or performance; minimum 0.0625 inch thick (16 gauge), unless otherwise indicated.

2.3 MANUFACTURED UNITS

A. Reglets:
1. General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated.
2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
3. Plaster Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
5. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
6. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing lower edge.
a. Material: Galvanized steel, thickness matching material being installed, unless otherwise noted.

2.4 ACCESSORIES

A. Solder:
1. For galvanized steel: ASTM B 32 "Specification for Solder Metal," Grade Sn50, used with rosin flux.
2. For stainless steel: ASTM B 32 "Specification for Solder Metal," Grade Sn60, used with an acid flux of type recommended by stainless-steel sheet manufacturer; use a noncorrosive rosin flux over tinned surfaces.

B. Stainless Steel Welding Rods:
1. Type recommended in writing by stainless-steel sheet manufacturer for type of metal sheets furnished

C. Fasteners:
1. Same material as sheet metal or other non-corrosive metal as recommended by sheet metal manufacturer, unless otherwise indicated on the drawings.
a. Match finish of exposed heads with material being fastened.

D. Electrolytic Insulation:
1. Asphalt Mastic:
a. SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4-mm) dry film thickness per coat.
2. Other electrolytic insulation materials:
a. Asphalt impregnated felt, neoprene or EPDM rubber.

E. Sealants shall be in accordance with Specification Section - SEALANTS.
1. Mastic Sealant:
a. Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
2. Elastomeric Sealant:
a. Generic type recommended by sheet metal manufacturer and fabricator of components being sealed.
3. Epoxy seam sealer:

a. 2-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior nonmoving joints, including riveted joints.

F. Adhesives:
1. Type recommended by sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of sheet metal.

G. Metal Accessories:
1. Provide sheet metal clips, straps, anchoring devices, screens, mesh, and similar accessory units as required for installation of work, matching or compatible with material being installed; noncorrosive; size and thickness matching material being installed.

H. Roofing Cement:
1. ASTM D 4586 "Specification for Asphalt Roofing Cement, Asbestos Free," Type I.
a. Verify with roofing material utilized for this project as being compatible with materials and roofing manufacturer's warranty requirements.

I. Gutter Sealing System (when applicable):
1. Primer:
a. Suitable for metal gutter metal type and compatible with Coatings and Fabrics.
2. Base, Intermediate and Finish Layer Coating:
3. Base Layer Fabric: Polyester Fabric compatible with primer and coatings.

J. Penetration Flashing:
1. Self-Adhered and self-healing weather barrier strips, in accordance with FS UU-B-790a, Grade A.
a. 40 mil. minimum thickness, in 9 inch and 12 inch widths as is appropriate for the barrier application.

2.5 FABRICATION

A. Sheet Metal Fabrication Standard: Fabricate sheet metal to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.
1. Comply with details shown to fabricate sheet metal that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
2. Form exposed sheet metal work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.
3. Seams:
a. Fabricate nonmoving seams in sheet metal with "Drive Cleat" or "Lock" seams.
4. Expansion Provisions:
a. Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches of corner or intersection.
b. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
c. Gutter Expansion control and design, unless otherwise indicated on the drawings:
1) Ends of a gutter shall occur no more than fifty (50) feet apart with at least one downspout in between, and gapped in accordance with Chapter 1, Table 1-7.
2) Adjacent ends shall be telescoped or enclosed with covers in a manner to accommodate expansion as indicated in Chapter 1, Fig. 1-5 to 1-7 and 1-10.
5. Sealed Joints:
a. Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

6. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.
7. Conceal fasteners and expansion provisions where possible.
    a. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.
8. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
    a. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.6 FINISHES

A. Shop Finishing:
1. All exterior galvanized sheet metal, unless specified otherwise, shall have all surfaces, except surfaces receiving roofing felt, properly cleaned and prepared and then painted with one coat Galvanized Metal Primer prior to installation.
    a. Galvanized Metal Primer: 4020PF "DEVGUARD," or approved equivalent.
    b. Galvanized repair paint: High-Zinc-Dust-Content, in accordance with SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight paint for re-galvanizing welds and repair painting galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
B. Protection:
1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
C. Surface preparation:
1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.
3. Prime substrates as required by manufacturer's written instructions and recommendations.

3.3 INSTALLATION

A. General:

1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.
5. Structurally reinforce and anchor work as required.
6. Work shall be weather and water tight as required.
7. Where dissimilar metals come into surface contact, cover surface in contact with electrolytic insulation.
8. Immediately following installation, and prior to roofing application, the metal will be primed with a quick drying primer compatible with roofing system installed and in compliance with roofing manufacturer's warranty requirements.

B. Layout:
1. Lines shall be straight and true.
2. Field mitered joints shall be neat, true to line, and water tight.
3. Fastening: In accordance with approved shop drawings.
4. Sealants: Seal all joints with sealant.

C. Assistance:
1. Installation shall be in direct consultation and review of roofing system manufacturer where applicable.

D. Penetration Flashing:
1. Apply Penetration Flashing in conjunction with Water Barriers, Metal Accessories and all other related work.
2. Install Penetration Flashing at all openings and penetrations at all exterior walls and at interior walls considered to be "Semi-Wet" and "Wet" exposures (i.e., Toilets, Showers, Lockers, Kitchens, etc.).
3. Install Penetration Flashings with Water Barriers, Metal Accessories and all other related work in "shingle" or "weatherboard" fashion.
4. Penetration Flashings shall be installed as required in CBC Sections 1404.4 in 9" widths and continuous to 9" past all intersections around all openings, penetrations and termination ofSheet Metal Systems.
   a. Should any penetration warrant a greater width of wall flashing, provide 12" wide flashing as required.
   b. When an object extends through the Sheet Metal System, return the edge of the Penetration Flashing 1" and apply to the sides of the penetrating item.
5. Objects such as electrical back-boxes, electrical speaker enclosures, penetrations created by structural members, and the like.

3.4 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
1. Clean any soiled surfaces immediately.
2. Finish shall be clean and ready for the application of any additional finishes.

3.5 SCHEDULES

A. Architectural Sheet Metal Items: Items visible from the interior occupied spaces and from all exterior viewing positions. Fabrication of all Architectural Items shall provide a fully finished appearance on all visible surfaces. Fabrication shall be soldered or welded joints and ground smooth. Solid flat head riveted joints may be used if necessary, but limited in use and must be indicated on the shop drawings by the fabricator, and accepted by the Architect. The use of sheet metal screws, pop rivets, or bolts are not be permitted. All joints between section shall be uniformly gapped with a maximum of 1/16" and splice backing shall be centered on the joint.

B. Utility Sheet Metal Items: Items not visible from the interior occupied spaces nor from exterior viewing positions. Fabrication of all Utility Items shall be in accordance with SMACNA Standards and shop practices.

C. Sheet Metal Schedules are not considered as a complete list. Refer to Drawings for locations of all conditions requiring sheet metal items.

D. Multiple types of material are specified for various items in the Schedules. Verify with roofing manufacturer as to which material shall be used to be compatible to the roofing material provided and to satisfy roofing warranty requirements.

E. Materials gauges specified for Items in the Schedules are minimum and shall be provided unless otherwise noted on the Drawings.

F. Schedule's Remarks / SMACNA No., 6th Edition, and are references of the standards for fabrication. Refer to Drawings for configurations and other fabrication requirements of sheet metal items.

G. Architectural Sheet Metal Items

ARCHITECTURAL SHEET METAL ITEMS					
ITEM	**LOCATION**	**MAT.**	**GA.**	**FINISH**	**REMARKS / SMACNA NO., 6th Edition**
Parapet Cap	Parapet Walls	Steel	20	Shop	Chapter 3, similar to Fig. 3-4A or Fig. 3-4G with E-1 and E-4 edge styles, as indicated on drawings. Provide J9 "Drive Cleat" joints, typical.
Cap Coping	Parapet Walls	Steel	20	Shop	Chapter 3, similar to Fig. 3-4G with E-4 edge style, as indicated on drawings. Provide J9 "Drive Cleat" joints, typical.
Drip Flashing	Various Conditions	Steel	22	Shop	Chapter 4, minimum 4" under finish and minimum 4" cover. Provide J2 "Butt & Backup Plate" joints with 1/16" gap. Fabricate Transition pieces and End Caps.
Counter Flashing	Various Conditions	Steel	22	Shop	Chapter 4, minimum 4" under finish and minimum 4" cover with 3/4" hemmed drip. Provide J2 "Butt & Backup Plate" joints with 1/16" gap. Fabricate Transition pieces and End Caps.
Opening Heads, Jambs & Sill Flashing	Metal Frames	Steel	22	Shop	Weld and Grind smooth all joints
Opening Heads, Jambs & Sill Flashing	Aluminum Windows	Alum	0.0253	Match Aluminum Window Finish.	Seal all joints.
Opening Heads, Jambs & Sill Flashing	Storefront	Alum	0.0253	Match Storefront Finish.	Seal all joints.
Opening Heads, Jambs & Sill Flashing	Curtain Wall	Alum	0.0253	Match Curtain Wall Finish.	Seal all joints.
Wall Penetration Flashing	Exterior Wall	Steel	22	Shop	Similar to Chapter 6, Figures 6-36, 37, 38 & 39.
Scuppers	Parapet Wall	Steel	22	Shop	Chapter 1, similar to Fig. 1-26A-B or 1-30A-B.
Gutters	Exterior	Steel	18	Shop	Chapter 1, Fig. 1-1. Provide expansion joints similar to Fig. 1-7. Solder overflow and downspout outlets.
Gutters	Concealed	Stainless Steel	18	Shop	Chapter 1, Fig. 1-1. Provide expansion joints similar to Fig. 1-7. Solder overflow and downspout outlets. Continuous welds.
Conductor Head	Exterior	Steel	18	Shop	Chapter 1, similar to Fig. 1-25. Solder downspout outlet.
Down Spouts	Exterior	Steel	18	Shop	Chapter 1, similar to Fig. 1-31, 1-32A or B. Provide Fig. 1-35B or J hangers.
Fascia Panels	Exterior	Steel	18	Shop	Weld and grind smooth all joints.
Color Band Panels	Exterior	Steel	18	Shop	Weld and grind smooth all joints.
Serving Counter	Serving Counter	S.S.	16	#4	Weld and Grind smooth all joints
Work Counter	Work	Steel	16	Shop	Weld and Grind smooth all joints

ARCHITECTURAL SHEET METAL ITEMS					
ITEM	**LOCATION**	**MAT.**	**GA.**	**FINISH**	**REMARKS / SMACNA NO., 6th Edition**
	Counter				
Fabricated Tilt Mirror	Student Restrooms	S.S.	16	#4	Weld and grind smooth all joints.

H. Utility Sheet Metal Items

UTILITY SHEET METAL ITEMS					
ITEM	**LOCATION**	**MAT.**	**GA.**	**FINISH**	**REMARKS / SMACNA NO., 6th Edition**
Clips & Cleats	Various Conditions	Steel	22	Shop	
Parapet Boot Flashing	Parapet Cap & Cap Coping	Steel	18	Shop	Solder all joints. Minimum 4" under finish and min. 4" cover.
Counter Flashing	Various Conditions	Steel	22	Shop	Minimum 4" under finish and min. 4" cover with ¾" hemmed drip. Provide J2 "Butt & Backup Plate" joints with 1/16" gap. Fabricate Transition pieces and End Caps.
Reglet & Counter Flashing	Plaster Parapets	Steel	24	Shop	FRY Spring Lock Type "ST" with "Spring-Loc" Flashing. Preformed transition pieces and end caps.
Reglet & Counter Flashing	Plaster Parapets	Steel	24	Shop	FRY Spring Lock Type "STX" with "Spring-Loc" Flashing. Preformed transition pieces and end caps.
Reglet & Counter Flashing	Masonry Parapet	Steel	24	Shop	FRY Spring Lock Type "MA" with "Spring-Loc" Flashing. Preformed transition pieces and end caps.
Reglet & Counter Flashing	Masonry Parapet	Steel	24	Shop	FRY Spring Lock Type "SM" with "Spring-Loc" Flashing. Preformed transition pieces and end caps.
Structural Support Flashing	Roof Penetration	Steel	18	Shop	Chapter 4, Similar to Figures 16A or B or C if welded or soldered, and grind smooth.
Vent Pipe Flashing	Roof Penetration	Lead or Steel	4#/sf or 22	Shop	Chapter 4, Fig. 4-15B.
Pipe or Conduit Flashing	Roof Penetration	Lead or Steel	4#/sf or 22	Shop	Chapter 4, similar to Figure 4-15C.
Multiple Pipe or Conduit Flashing	Roof Penetration	Lead or Steel	4#/sf or 22	Shop Or Shop	Chapter 4, similar to Figure 4-15A or 4-15B.
Insulated Pipe Flashing	Roof Penetration	Lead or Steel	4#/sf or 22	Shop	Chapter 4, Similar to Fig. 4-15C. Refer to Plumbing.
Mechanical Flue Pipe Flashing	Roof Penetration	Lead or Steel	4#/sf or 22	Shop	Chapter 4, Similar to Fig. 4-15C. Refer to Plumbing.
Manufactured Curb Flashing	Roof Penetration	Steel.	22	Shop	Provide formed metal corners lapped 6" with sheet metal screws with neoprene washers at 18" o.c.
Hatch Flashing	Roof Penetration	Steel.	22	Shop	Provide formed metal corners lapped 6" with sheet metal screws with neoprene washers at 18" o.c.
Ventilating Units Flashing	Roof Penetration	Steel.	22	Shop	Provide formed metal corners lapped 6" with sheet metal screws with neoprene washers at 18" o.c.
Scuppers	Parapet Screens	Steel.	22	Shop	Chapter 1, similar to Fig. 1-26A-B or 1-30A-B.
Roof Splash Pans	Roof	Steel.	22	Shop	Chapter 1, Fig. 1-36, 2-rib corrugation section..
Valley Flashing	Metal Panel Roof	Steel.	22	Shop	Chapter 6, Similar to Fig. 6-6 or Fig. 1-21 or Fig. 1-23, Detail 10, or Fig. 6-9, Detail 7 and Chapter 4, Fig. 4-10.
Built-in Gutter	Metal Panel	S.S.	16	Shop	Chapter 1, similar to Fig. 1-4 or Fig. 1-21 or

UTILITY SHEET METAL ITEMS					
ITEM	**LOCATION**	**MAT.**	**GA.**	**FINISH**	**REMARKS / SMACNA NO., 6th Edition**
	Roof				Fig. 1-23. Provide expansion joint similar to Fig. 1-8. Weld and grind smooth all joints.
Louver Screens	Louvered Openings	Steel.	14	Shop	Chapter 7, Fig. 7-7A or B. Provide 12 gauge (0.105) 3 x 3 welded wire mesh.
Plumbing Sheet Metal	Various Plumbing Conditions	Steel.	22	Shop	Refer to Plumbing Drawings and Specifications.
Mechanical Sheet Metal	Various Mechanical Conditions	Steel.	22	Shop	Refer to Mechanical Drawings and Specifications.
Electrical Sheet Metal	Various Electrical Conditions	Steel.	22	Shop	Refer to Electrical Drawings and Specifications.
Roof and Overflow Drain Pans	Roof	Lead	#4	Shop	See Details.
Mechanical, Large Flue Flashing	Roof Penetration	Steel	22	Shop	Chapter 4, Detail 4-14A.

END OF SECTION

SECTION 07 72 00 – ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all roof accessory materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 05 12 00 STEEL AND FABRICATIONS
   4. 05 30 00 METAL DECK
   5. 06 10 00 ROUGH CARPENTRY
   6. 07 40 00 METAL PANELS
   7. 07 51 13 BUILT-UP ROOFING
   8. 07 60 00 SHEET METAL
   9. 07 92 00 SEALANTS
   10. 09 22 16 METAL FRAMING
   11. 09 91 00 PAINTING
   12. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with the following standards:
      a. ASTM American Society for Testing and Materials
      b. LIA Lead Industries Association.
      c. NRCA National Roofing Contractors Association (If the roofing system scheduled to be installed calls for related sheet metal flashing to be in accordance with NRCA detailing in order to satisfy their warranty requirements, then the NRCA detailing shall govern in lieu of SMACNA standards.)
      d. OSHA Occupational Safety and Health Administration
      e. SMACNA Sheet Metal and Air Conditioning Contractor's National Association, latest Edition, Architectural Sheet Metal Manual.

1.3 SYSTEM DESCRIPTION

A. (Manufactured Curbs Only) This section specifies curbs for mechanical and electrical equipment specified in Division 23 and Division 26, as well as architectural curbs in Division 05, Division 07 and Division 08. These curbs are designed and fabricated as welded single piece units that are structurally designed by the manufacturer to span structural framing. The curbs require structural calculations from the manufacturer in accordance with the CBC for the mechanical or electrical units supplied that are mounted on top of the curbs.
   1. Manufactured curbs shall be designed, engineered, and fabricated for exact mechanical units selected after bid, and can be designed for compound slopes and difficult roofing conditions. Designs shall accommodate each type of roofing condition.
   2. All curbs shall be designed to be a minimum of 8-inches above the finished roof at the top most portion of the curb, and designed with crickets for watertight connections.

3. Construct curbs to match roof slopes with plumb and level top surfaces for mounting mechanical or electrical equipment.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Coordination Drawings (Manufactured Curbs only):
   a. Manufacturer(s) shall coordinate with the Contractor and the Roofing Subcontractor all applicable work placed on or penetrating the roof deck and roof membrane system for the proper selection of Roof Accessories for this project. Manufacturer shall coordinate with the Contractor all weights and dimensions from approved shop drawings of mechanical equipment and piping/conduit required for this project and fabricate accordingly. All items coordinated (including Structural Calculations) shall be presented within the shop drawings for the Architect's and Structural Engineer of Record's review.
2. Product Data.
   a. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
   b. Submit manufacturer's standard color range for selection by the Architect.
3. Shop Drawings.
   a. Submit shop drawings prepared by, or under the supervision of a registered Civil or Structural Engineer in the State of California, detailing fabrication and assembly of the work under this section, as well as procedures and diagrams. Include setting drawings, templates, and directions for installation of anchor bolts and other anchorage to be installed as unit of work of other related sections.
      1) Manufactured Curbs must be coordinated with the Structural Shop Drawings and Mechanical / Electrical Equipment supplied as to size and weights for any roof top installation.
4. Quality Assurance/Control Submittals:
   a. Manufacturer's Written Instructions:
      1) Manufacturer's written instructions.
5. Closeout Submittals in accordance with the following:
   a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
   b. Operation Data in accordance with Specification Section - PROJECT CLOSEOUT.
   c. Record Documents in accordance with Specification Section - RECORD DOCUMENTS.
   d. Warranty in accordance with Specification Section - WARRANTIES.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications:
   a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
2. Manufacturer/Supplier Qualifications:
   a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. In accordance with Specification Section - REGULATORY REQUIREMENTS.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
   1. Products shall be individually wrapped.
   2. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:
   1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
   2. Damaged products will not be accepted.

C. Storage and protection:
   1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
      a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.7 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. Hatch Railing System shall provide a warranty against defects in material and workmanship:
      a. Warranty Period Five (5) Years.
         1) From the Date of Substantial Completion.

C. Installer's Warranty:
   1. Weather Tightness Warranty for Roof Accessories: Manufacturer's Standard form in which manufacturer agrees to repair or replace Roof Accessory assemblies that fail to remain weathertight, including leaks within specified warranty period. Warranty shall guarantee manufactured Roof Accessories to be free from defects in materials or workmanship.
      a. Warranty Period Five (5) Years.
         1) From the Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MANUFACTURED CURBS

A. General:
   1. Curbs shall be constructed to match roof slope of roof and provide a level top surface for mounting of mechanical equipment.
      a. Minimum height of all curbs shall be 8 inches above finished roof per NRCA requirements.

B. Equipment Curbs:
1. Manufacturer: ROOF PRODUCTS, INC.
a. Model Number:
1) Membrane Roof: RPC-5.
2) Metal Roof: RPMB-5.
b. Acceptable alternative manufacturer: ROOF PRODUCTS & SYSTEMS CORP.
2. Factory installed pressure treated wood nailers.
3. Welded 18 gauge minimum galvanized steel shell and base plate, as applicable to roof equipment situation, with continuous mitered and welded corner seams.
4. 3 lb. density rigid fiberglass insulation board.
5. Internal angle reinforcing (1" x 1" x 12 gauge) on sides greater than 36 inches in length, spaced 24 inches o.c.
6. All welds to be coated with manufacturer's "Alumanation 100."
7. Internal curb duct supports as required for the type of Mechanical units selected for the project.

C. Equipment Platform:
1. Manufacturer: ROOF PRODUCTS, INC.
a. Model Number:
1) Membrane Roof: RPPF-5.
2) Metal Roof: RPMB-5.
b. Acceptable alternative manufacturer: ROOF PRODUCTS & SYSTEMS CORP.
2. Factory installed pressure treated wood nailers.
3. Welded 18 gauge minimum galvanized steel shell and base plate, as applicable to roof equipment situation, with continuous mitered and welded corner seams.
4. 3 lb. density rigid fiberglass insulation board.
5. Internal angle reinforcing (1" x 1" x 12 gauge) on sides greater than 36 inches in length, spaced 24 inches o.c.
6. All welds to be coated with manufacturer's "Alumanation 100."
7. Internal curb duct supports as required for the type of Mechanical units selected for the project.
8. Platform Cover:
a. Welded 18 gauge galvanized steel construction.
b. Cover cross broken for positive water run-off.
c. Flared drip edge.
d. Flat Lock and Soldered seams on covers 43 inches x 105 inches and larger.
9. Platform: Provide 1-1/8" thick fire-retardant treated T & G plywood top sheathing
10. Vapor Retarder: Two layers of 15lb building paper between plywood platform and curb cover.

D. Equipment Supports:
1. Manufacturer: ROOF PRODUCTS, INC.
a. Model Number:
1) Membrane Roof: RPES-3.
b. Acceptable alternative manufacturer: ROOF PRODUCTS & SYSTEMS CORP.
2. 18 gauge minimum galvanized steel shell, base plate and counterflashing.
3. Factory installed pressure treated wood nailer.
4. Internal bulkhead re-enforcement.
5. All welded construction.
6. Vapor Retarder: Two layers of 15lb building paper between wood nailer and counterflashing.

E. Accessories:
1. Square to Round adapter as indicated on the drawings:
a. Cross broken for positive run-off.
b. Type WG 16 gauge galvanized steel construction.

c. Watertight construction.
d. Insulated to prevent condensation.

2. "Decktite" roof pipe boots in size and number applicable to the size of pipes penetrating the equipment platform indicated in the Contract Documents.
3. Fasteners as required by the manufacturer for the proper installation of the roof curbs and weather resistant coating as standard with the manufacturer.
4. Neoprene strips, sheets or washers as required by the manufacturer for weathertight construction.
5. Provide Isolation Rails as required by Mechanical in DIV. 23 or Electrical in DIV. 26.

2.3 ROOF HATCH SYSTEM

A. General: Coordinate dimensions with roughing-in information.
1. When installed on a slope, run the hinge side parallel with the slope.

B. Roof Hatch:
1. Manufacturer: BILCO COMPANY.
a. Model Number: Type S-50TB
b. Acceptable alternative manufacturer: BABCOCK DAVIS HATCHWAYS, INC.
2. Size: 30 inch x 36 inch,
3. Cover:
a. Material: 11 gauge aluminum.
b. Insulation: 3 inch polyisocyanurate (R-value 20+).
c. Liner: 18 gauge aluminum.
d. Seal: Heavy duty EPDM, all sides.
e. Flange: 5 inch beaded.
4. Curb:
a. Material: 11 gauge aluminum.
b. Insulation: 3 inch polyisocyanurate (R-value 20+).
c. Height: Minimum height 12 inches to allow for 8 inches of vertical flashing above the finished roof. Custom heights available maximum of 24 inches.
5. Cap Flashing: 11 gauge aluminum integral with curb, fully welded at the corners.
6. Hardware:
a. Material: Stainless steel.
b. Hinges: Heavy Pintle.
c. Operators: Compression springs enclosed in telescopic tubes.
d. Latch: Positive snap with turn handles and padlock hasps inside and outside.
e. Cover Seal: EPDM, all sides.
f. Hold-open Arms: Automatic with handle for one hand release with a 1” diameter red vinyl grip handle to permit easy release for closing.
7. Finish: Mill finish aluminum.

C. Roof Hatch Ladder Post:
1. Manufacturer: BILCO COMPANY.
a. Model Number: LadderUP®Safety Post LU-2.
2. General:
a. Safety post shall comply with all OSHA and Cal OSHA safety guidelines for this work.
b. Safety Post shall be mounted so as not to interfere with the proper operation of any roof hatch covers.
3. Performance Characteristics:
a. Tubular Post shall lock automatically when fully extended.
b. Safety Post shall have controlled upward and downward movement.
c. Release lever shall disengage the post to allow it to be returned to its lowered position.

d. Post shall have adjustable mounting brackets to fit ladder rung spacing up to 14" on center and clamp brackets to accommodate ladder rungs up to 1-3/4" in diameter.
e. If hollow rungs are encountered, provide solid bars of equal length as hollow rungs of diameter suitable for insertion into hollow rungs to prevent crushing of the rungs due to clamping of the Safety Post.

4. Post: Hot dip galvanized finish, suitable for mounting on rear of ladder to top two rungs with clamp brackets, including all fasteners required.
   a. All materials for Safety Post shall be in compliance with ASTM A 36, "Standard Specification for Structural Steel."
   b. Post shall be manufactured of high strength galvanized steel square tubing. A pull up loop shall be provided at the upper end of the post to facilitate raising the post.
5. Balancing Spring: Provide a stainless steel spring balancing mechanism to provide smooth, easy, controlled operation when raising and lowering the safety post.
6. Hardware: Spring nuts shall be galvanized steel, and all other mounting hardware shall be Type 316 stainless steel.

D. Roof Hatch Railing System:
1. Manufacturer: BILCO COMPANY.
   a. Model Number: "Bil-Guard 2.0" Hatch Railing System.
2. General:
   a. System shall comply with the requirements of OSHA 29 CFR 1910.23 and shall meet OSHA strength requirements with a safety factor of two.
   b. System shall attach to the capflashing of the roof hatch and shall not penetrate any roofing material.
   c. Hinged gate shall ensure continuous barrier around roof hatch.
3. Posts, Rails and Gate:
   a. Material: Aluminum Schedule 40 6061 T6 alloy, 1-1/4" outside diameter.
4. Hardware:
   a. Gate Locking Mechanism: cast aluminum.
   b. Hinges: Spring hinges, type 316 stainless steel, 3/8 inch thick.
   c. Fasteners: Type 316 stainless steel.
5. Accessories:
   a. Provide all bolts, locknuts, washers, pins, screws, nylon washers, neprene pads, and torsion rods, etc. required for a complete assembly.
6. Finish: Manufacturer's powder coat.
   a. Color: Light gray.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:

1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:
1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

C. Surface Preparation:
1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

3.3 INSTALLATION

A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
   a. Provide Hatch Railing System on all hatches.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.
5. Damaged products shall not be installed.

B. Layout:
1. Lines shall be straight and true.

3.4 FIELD QUALITY CONTROL

A. Site Tests:
1. As required by Regulatory Requirements.

B. Inspection:
1. As required by Regulatory Requirements.
2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
3. No work shall be without the inspections required by Regulatory Requirements.

3.5 ADJUSTING

A. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

3.6 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
1. Clean any soiled surfaces immediately.
2. Finish shall be clean and ready for the application of any additional finishes.
3. In accordance with manufacturer's written instructions and recommendations.

END OF SECTION

SECTION 07 84 00 – FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all Firestopping (a.k.a. Through-Penetration Firestop Systems) materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 30 00 CAST-IN-PLACE CONCRETE
4. 04 22 00 CONCRETE MASONRY UNITS
5. 05 12 00 STEEL AND FABRICATIONS
6. 05 30 00 METAL DECK
7. 06 10 00 ROUGH CARPENTRY
8. 07 21 00 INSULATION
9. 07 42 43 FIBER-CEMENT PANELS
10. 09 22 16 METAL FRAMING
11. 09 24 00 CEMENT PLASTER
12. 09 29 00 GYPSUM BOARD
13. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
14. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 REFERENCES:

A. Standards:

1. In accordance with the following standards:
   a. UL Underwriters Laboratory Inc.
      1) Fire Resistance – Volume 2A.
      2) Fire Resistance – Volume 2B.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: It is the intention of this specification and the drawings to form a guide for a complete firestopping system that resists the spread of fire and the passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated, according to the requirements indicated herein. Any items not specifically noted but necessary for a complete and operable firestopping system shall be provided under this section.

1. Provide only products that when securely installed and capable of maintaining its integrity when subjected to the time-temperature curve of CRSC, Table 12-7-3A.
   a. Provide firestopping systems with F-ratings that comply with hourly wall, ceiling, floor or roof ratings indicated on the drawings, as determined per ASTM E 814 "Test Method for Fire Tests of Through-Penetration Fire Stops," but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated and UL 479.

b. Provide firestopping systems with T-ratings that comply with hourly wall, ceiling, floor or roof ratings indicated on the drawings, in addition to F-ratings, as determined per ASTM E 814 "Test Method for Fire Tests of Through-Penetration Fire Stops," and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas.
c. Provide joint sealants with fire-resistance ratings that comply with hourly wall, ceiling, floor or roof ratings as indicated on the drawings, as determined per ASTM E 119 "Test Method for Fire Tests of Through-Penetration Fire Stops," with hose stream test, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.
d. For firestopping systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
e. For all firestopping, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials."
f. Comply with "L" Rating where penetrating Smoke Barrier for Walls & Floors, per CBC 714.5, and CBC 714.4 for penetrations in smoke barriers and meeting the requirements of UL 1479 for air leakage.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
1. Product Data.
a. Provide the manufacturer's full-line of products showing the UL Number listings and the products associated for each UL Number Listing.
1) The installer shall pick from the manufacturer selected for this Project the appropriate firestopping system from the manufacturer's full-line product catalog and compile a record of each penetration indicating compliance with the firestopping UL Number used.
2. Shop Drawings:
a. For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing nd inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
1) Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each firestopping system configuration for construction and penetrating items.
3. Quality Assurance/Control Submittals:
a. Design Data.
b. Test Reports:
1) Product Test Reports: From a qualified testing agency indicating firestopping system complies with requirements, based on comprehensive testing of current products.
c. Certificates:
1) Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's) and are nontoxic to building occupants.
2) Product Certificates: Signed by manufacturers of firestopping system products certifying that products furnished comply with requirements.
d. Manufacturer's Written Instructions:
4. Closeout Submittals in accordance with the following:

a. Record Documents in accordance with Specification Section - RECORD DOCUMENTS.
   1) Record Documents shall consist of the the compilation of actual firestopping UL Numbers used along with the comparable Manufacturer's Product associated with that UL Number, indicating the actual location of the firestopping installation within this project.
b. Warranty in accordance with Specification Section - WARRANTIES.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Material Qualifications:
      a. All products shall have UL Number Listings and be approved and listed by the California State Fire Marshal.
   2. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
      b. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
   3. Manufacturer/Supplier Qualifications:
      a. Manufacturer shall demonstrate a full-line of firestopping products capable of meeting the conditions associated with the scope of this Project, that have UL numbers and be approved and listed by the California State Fire Marshal.
      b. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
   4. In accordance with Specification Section - REGULATORY REQUIREMENTS.

1.6 DELIVERY, STORAGE, AND HANDLING

1. Packing, shipping, handling, and unloading:
   a. Products shall be individually wrapped.
   b. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage. Damaged products will not be accepted.
2. Acceptance at Site:
   a. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
   b. Damaged products will not be accepted.
3. Storage and protection:
   a. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
   b. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.7 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
   2. Ventilate firestopping per firestopping manufacturers' written instructions by natural means or, where this is inadequate, forced air circulation.
   3. Existing Conditions:

a. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
b. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

1.8 SEQUENCING AND SCHEDULING

A. Notify Owner's inspection agency at least one (1) week in advance of firestopping installations; confirm dates and times on days preceding each series of installations.
B. Do not cover up firestopping installations that will become concealed behind other construction until Owner's inspection agency and authorities having jurisdiction have examined each installation.

1.9 WARRANTY

A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.
B. Manufacturer's Warranty:
1. In accordance with manufacturer's written standard warranty:
a. Warranty Period One (1) Year.
C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES:
a. Warranty period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
1. Specified firestopping product manufacturer:
a. 3M FIRE PROTECTION PRODUCTS.
b. Acceptable alternative manufacturers:
1) A/D FIRE PROTECTION SYSTEMS INC.
2) HILTI CONSTRUCTION CHEMICALS, INC.
3) SPECIFIED TECHNOLOGIES INC.
2. Specified Safing Insulation product manufacturer:
a. THERMAFIBER
B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Compatibility: Provide firestopping systems from only one manufacturer per penetration protective, with the substrates, and provide firestopping systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating firestopping systems, under conditions of service and application, as demonstrated by firestopping system manufacturer based on testing and field experience.

1. Firestopping of Fire-Rated Construction:
   a. Provide systems or devices listed in the UL Fire Resistive Directory under categories XHBN for Joint Systems and XHEZ for Firestops, providing those products conform to the construction type, penetrate type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall applications. Systems or devices must be asbestos-free.
   b. In addition, products must withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the UL system or device, and designed to perform this function.
2. Construction-Gap Firestopping of Fire-Rated Construction: Provide products from the manufacturer listed in the Systems and Applications Schedule at the end of this section for the following conditions (if applicable):
   a. Firestopping at construction gaps between edges of floor slabs and exterior wall construction (Perimeter Fire Containment Systems).
   b. Firestopping at construction gaps between tops of partitions and underside of structural systems (Joint Systems).
   c. Firestopping at construction gaps between tops of partitions and underside of ceiling or ceiling assembly (Joint Systems).
   d. Firestopping of control joints in fire-rated masonry partitions.
   e. Firestopping of expansion joints not indicated by another proprietory expansion system manufacturer.
3. Smoke-Stopping at Smoke Partitions:
   a. Through-penetration smoke-stopping: Provide any system or devices complying with the requirements for firestopping in fire-rated construction listed in the Systems and Applications Schedule at the end of this section, provided that the system includes the specified smoke seal or will provide a smoke seal.
   b. Construction-gap smoke-stopping: Provide any system or devices complying with the requirements for construction-gap firestopping in fire-rated construction listed in the Systems and Applications Schedule at the end of this section, provided that the system includes the specified smoke seal or will provide a smoke seal.

B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by firestopping system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:
   a. Slag-/rock-wool-fiber insulation.
   b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
   c. Fire-rated form board.
   d. Fillers for sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.
6. Identification Labels: Provide pressure-sensitive, self-adhesive, preprinted vinyl labels, with the following information on the labels:
   a. The words: "Warning--Firestopping System--Do Not Disturb. Notify Building Management of Any Damage."

b. Contractor's name, address, and phone number.
c. Firestopping system designation of applicable testing and inspecting agency.
d. Date of installation.
e. Firestopping system manufacturer's name.
f. Installer's name.

C. Fill Materials:

1. General: Provide firestopping systems containing the types of fill materials indicated in the Firestopping System Schedule at the end of Part 3 by reference to the types of materials described in this Article. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
2. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
3. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
4. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
5. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
6. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
7. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
8. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
9. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
10. Safing Insulation: 2" minimum to 4" thick Safing Insulation, as required on the drawings. Provide manufacturer's recommended fasteners as required for the specific installation requirements.
    a. Flame Spread and Smoke Developed Index maximum as follows in accordance with ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials":
        1) Unfaced Safing Insulation: Flame Spread Index 15, Smoke Developed Index 0.
        2) Foil Faced Safing Insulation: Flame Spread Index 25, Smoke Developed Index 5.
11. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
12. Silicone Sealants: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
    a. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
    b. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.3 MIXES

A. For those products requiring mixing before application, comply with firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
   1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
   2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
   3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
B. Protection:
   1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
C. Surface preparation:
   1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
   2. Clean substrates of substances (laitance, form-release agents from concrete, oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.
   3. Primers: Prime substrates where recommended in writing by firestopping system manufacturer using that manufacturer's written recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
   4. Masking Tape: Use masking tape to prevent firestopping systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 INSTALLATION

A. General:
   1. All firestop system installers shall be certified in writing for each firesafing and firestopping assembly by the product manufacturer.
   2. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
   3. In accordance with approved submittals.
   4. In accordance with Regulatory Requirements.
   5. Set plumb, level, and square.

6. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
7. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
    a. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
8. Install fill materials for firestop systems by proven techniques to produce the following results:
    a. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
    b. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
    c. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
9. Identification Labels:
    a. Attach labels (see Part 2) permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems.

3.4 FIELD QUALITY CONTROL

A. Site Tests:
    1. As required by Regulatory Requirements.
B. Inspection:
    1. As required by Regulatory Requirements.
    2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
    3. No work shall be without the inspections required by Regulatory Requirements.
    4. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements at no cost to the Owner.

3.5 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
    1. Clean any soiled surfaces immediately.
    2. Finish shall be clean and ready for the application of any additional finishes.
    3. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by firestopping system manufacturers and that do not damage materials in which openings occur.

3.6 PROTECTION

A. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

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3.7 SCHEDULES

FIRESTOPPING SYSTEM SCHEDULE Firestop Systems Are Listed Using the Alpha-Alpha-Numeric Identification System Published in UL's Fire Resistance Directory, Vol. 2						
TYPE OF PENETRANT	CONSTRUCTION					
	FLOOR PENETRATION SYSTEMS (First Alpha Component = C or F)			WALL PENETRATION SYSTEMS (First Alpha Component = C or F)		
	Concrete Floors with a minimum Thickness Less Than or Equal to 5 inches	Concrete Floors with a minimum Thickness Greater Than 5 inches	Framed Floors	Concrete or Masonry Walls with a minimum Thickness Less Than or Qual to 8 inches	Concrete or Masonry Walls with a minimum Thickness Greater Than 8 inches	Framed Walls
NO PENETRATING ITEMS	C-AJ-0001-0999 OR F-A-0001-0999	C-BJ-0001-0999		C-AJ-0001-0999 C-BJ-0001-0999 OR W-J-0001-0999		W-L-0001-0999
METALLIC PIPE, CONDUIT, OR TUBING	C-AJ-1001-1999 OR F-A-1001-1999	C-BJ-1001-1999 C-BK-1001-1999 OR F-B-1001-1999	F-C-1001-1999	C-AJ-1001-1999 C-BJ-1001-1999 OR W-J-1001-1999	C-BK-1001-1999 OR W-K-1001-1999	W-L-1001-1999
NON-METALLIC PIPE, CONDUIT, OR TUBING	C-AJ-2001-2999 OR F-A-2001-2999	C-BJ-2001-2999 OR F-B-2001-2999	F-C-2001-2999	C-AJ-2001-2999 C-BJ-2001-2999 OR W-J-2001-2999		W-L-2001-2999
ELECTRICAL CABLES	C-AJ-3001-3999 OR F-A-3001-3999	C-BJ-3001-3999 OR F-B-3001-3999	F-C-3001-3999	C-AJ-3001-3999 C-BJ-3001-3999 OR W-J-3001-3999		W-L-3001-3999
CABLE TRAYS WITH ELECTRICAL CABLES	C-AJ-4001-4999 OR F-A-4001-4999	C-BJ-4001-4999		C-AJ-4001-4999 C-BJ-4001-4999 OR W-J-4001-4999	W-K-4001-4999	W-L-4001-4999
INSULATED PIPES	C-AJ-5001-5999 OR F-A-5001-5999	C-BJ-5001-5999	F-C-5001-5999	C-AJ-5001-5999 OR W-J-5001-5999		W-L-5001-5999

FIRESTOPPING SYSTEM SCHEDULE Firestop Systems Are Listed Using the Alpha-Alpha-Numeric Identification System Published in UL's Fire Resistance Directory, Vol. 2						
	CONSTRUCTION					
	FLOOR PENETRATION SYSTEMS (First Alpha Component = C or F)			WALL PENETRATION SYSTEMS (First Alpha Component = C or F)		
TYPE OF PENETRANT	Concrete Floors with a minimum Thickness Less Than or Equal to 5 inches	Concrete Floors with a minimum Thickness Greater Than 5 inches	Framed Floors	Concrete or Masonry Walls with a minimum Thickness Less Than or Qual to 8 inches	Concrete or Masonry Walls with a minimum Thickness Greater Than 8 inches	Framed Walls
MISC. ELECTRICAL PENETRANTS	C-AJ-6001-6999 OR F-A-6001-6999			C-AJ-6001-6999		W-L-6001-6999
MISC. MECHANICAL PENETRANTS	C-AJ-7001-7999 OR F-A-7001-7999		F-C-7001-7999	C-AJ-7001-7999 OR W-J-7001-7999		W-L-7001-7999
GROUPINGS OF PENETRATIONS	C-AJ-8001-8999 OR F-A-8001-8999	C-BJ-8001-8999	F-C-8001-8999	C-AJ-8001-8999 C-BJ-8001-8999 OR W-J-8001-8999		W-L-8001-8999
For each location where a fire-resistance-rated floor or wall assembly is penetrated, provide a UL-listed throughpenetration firestop system selected from the applicable UL number range listed above that complies with this Specification Section - FIRESTOPPING, and is suitable for the penetration conditions indicated for the Project.						

END OF SECTION

SECTION 07 92 00 – SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all joint sealant materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
   4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements: It is the intention of this specification section and the drawings to form a guide for a complete and operable system. Any items not specifically noted but necessary for a complete and operable system shall be provided under this section.
   1. Provide elastomeric sealants for exterior applications that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.
   2. Provide sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water-resistant and cause no staining or deterioration of joint substrates.

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product data from manufacturers for each joint sealant product required.
   2. Shop drawings:
      a. Provide full details of all sealants and accessories proposed for use for approval by the Architect. All materials and products proposed shall be compatible with each other and with the substrates and adjacent wall colors, and shall be non-staining and non-bleeding. Submit an affidavit from the manufacturer confirming the acceptance of the use of the selected products in the manner and on the substrates proposed.
   3. Samples.
      a. Samples for initial selection purposes in form of manufacturer's bead samples, consisting of strips of actual products showing full range of colors (standard, premium and custom) available, for each product exposed to view.
         1) Provide color chips of adjacent wall surface colors; to be used in evaluating the sealant color samples.
   4. Quality Assurance/Control Submittals:
      a. Provide UL Assembly Classification appropriate for each fire rated penetration.
      b. Certificates:
         1) Submit three (3) copies of certificates.

a) Certification by each joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.

b) Certified test reports for elastomeric sealants on aged performance as specified, including hardness stain resistance, adhesion, cohesion or tensile strength, elongation, low temperature flexibility, compression set, modulus of elasticity, water absorption, and resistance (aging, weight loss, deterioration) and heat and exposure to ozone and ultra violet light. Adhesion data shall include long-term adhesion characteristics of all adhesion surfaces including silicone, aluminum and glass coatings and long term weathering test on the silicone on contact with similar materials.

c) Certificate of Installation: Signed by the installer and sealant manufacturer stating that sealant installed complies with specifications, and that installation methods comply with manufacturer's printed instructions for each condition of installation and use on the project. The sealant installer shall have no less that five years of continuous experience in installing the specified products. Their experience shall include similar work to this subject project. In addition, the manufacturers will provide written approval of the material installers.

c. Manufacturer's Written Instructions:
   1) Submit three (3) copies of manufacturer's written instruction
d. Closeout Submittals in accordance with Specification Sections in Division One:
e. Warranty in accordance with Specification Section - WARRANTIES.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Material Qualifications:
      a. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.
   2. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
   3. Manufacturer/Supplier Qualifications:
      a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units and colors without causing delay in the work.

B. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
      a. AAMA American Architectural Manufacturer's Association
         1) AAMA 800-92 - "VOLUNTARY SPECIFICATIONS AND TEST METHODS FOR SEALANTS.
      b. ASTM American Society for Testing and Materials.
         1) ASTM C 1193 - "STANDARD GUIDE FOR USE OF JOINT SEALANTS."
      c. CA-CHPS California High Performance Schools
      d. GANA Glass Association of North America, 1997 Edition of the Glazing Manual, and the most recent Edition of the Sealant Manual.
      e. SCAQMD South Coast Air Quality Management District, Rule 1168.
      f. SWRI Sealant Waterproofing Restoration Institute - Types of standards as found in Chapter III "Sealants: The Professionals' Guide."

C. Meetings:
1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
a. Coordinate the work with all other related work.
b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
a. Review for proper installation of work progress.
b. Identify any installation problems and acceptable corrective measures.
c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
1. Comply with the Sealant Requirements of the GANA Glazing Manual and GANA Sealant Manual.

B. Store and handle materials in compliance with manufacturer's written recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.
1. Store sealant containers in a protected location in accordance with their manufacturer's printed instructions until their use.

1.6 PROJECT CONDITIONS

A. Environmental requirements:
1. Apply materials within manufacturer's written recommended surface and ambient temperature ranges.
2. Apply materials when working joints are most likely to be normal size.
3. Do not install sealants under adverse weather conditions, or when temperatures are beyond manufacturer's written recommended limits.
a. Proceed with the installation only when forecasted weather conditions are favorable for proper sealant cure, and development of early bond strength. Allow a minimum of three days after rain.
b. Where joint width is affected by ambient temperature variations, install sealants only when temperatures are in the lower third of manufacturer's written recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at low temperatures.

1.7 WARRANTY

A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
1. In accordance with Specification Section - WARRANTIES.
2. Manufacturer shall warrant exterior joint sealant after substantial completion of work.
a. Warranty Period Ten (10) Years.

C. Installer's Warranty:
1. Sealant Contractor shall warrant sealants against defective materials and workmanship after substantial completion of work.

a. Warranty Period Five (5) Years.
b. Warranty shall further state that installed sealants are warranted against the following:
   1) Water leakage through sealed joints.
   2) Adhesive or cohesive failure of sealant.
   3) Staining of adjacent surfaces caused by migration of primer or sealant.
   4) Chalking or visible color change of the cured materials.
c. The installer shall make repairs during the warranty period at no cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified product manufacturer, or approved equivalent:
   a. One-Part Neutral Cure Silicone Sealant:
      1) PECORA "#890"
         a) NOTE: For continual immersion in water conditions, provide PECORA "Dynatred".
         b) If the water contains a chlorine content of 5ppm, then PECORA "Synthacalk GC2+" shall be used.
      2) Acceptable alternative manufacturers for 1) only above:
         a) BONDAFLEX "Sil 290"
         b) DOW PERFORMANCE SILICONES "#790"
         c) SONNEBORN "Sonolastic 150" or "Sonolastic 150 VLM"
   b. One-Part Acid-Curing Silicone Sealant:
      1) PECORA "#860"
      2) Acceptable alternative manufacturers:
         a) BONDAFLEX "Sil 100 GP"
         b) DOW PERFORMANCE SILICONES "#999-A"
         c) SONNEBORN "Omniplus"
   c. One-Part Mildew-Resistant Silicone Sealant:
      1) PECORA:
         a) White Color Only "#345"
         b) Available in multiple colors for selection "#898"
      2) Acceptable alternative manufacturers to 1), a), above:
         a) BONDAFLEX "Sil 100 WF"
         b) DOW PERFORMANCE SILICONES "#786"
         c) SONNEBORN "Omniplus"
   d. One-Part Gun Grade Urethane Sealant:
      1) PECORA "Dynatrol I-XL"
      2) Acceptable alternative manufacturers:
         a) BONDAFLEX "Pur 25" or "Pur 25 Tex"
         b) SIKA "Sikaflex 1a" or "Sika Textured"
         c) SONNEBORN "NP1 Smooth" or "X1 Textured"
         d) VULKEM "#116"
   e. Multi-Component Gun Grade Urethane Sealant:

1) PECORA "Dynatred"
2) Acceptable alternative manufacturers:
   a) BONDAFLEX "Pur 2 NS"
   b) SIKA "Sikaflex 2c NS"
   c) SONNEBORN "NP2"

f. Multi-Component Gun Grade Urethane Sealant (Fast Curing):
1) PECORA "Dynatred"
2) Acceptable alternative manufacturers:
   a) BONDAFLEX "Pur 2 NS"
   b) SIKA "Sikaflex 2c NS"
   c) SONNEBORN "NP2" with manufacturer's accelerator.
   d) VULKEM "#227"

g. One-Part or Multi-Component Gun Grade Urethane Sealant (Security Sealant) :
1) PECORA "Dynaflex"
2) Acceptable alternative manufacturers:
   a) BONDAFLEX "Pur 2 NS"
   b) SIKA "Sikaflex 2c NS TG"
   c) SONNEBORN "Ultra"

h. One-Part Pourable Self-Leveling Urethane Sealant:
1) PECORA "Urexpan NR-201" or "Dynatred"
2) Acceptable alternative manufacturers:
   a) BONDAFLEX "Pur 35 SL"
   b) SIKA "Sikaflex 1c SL"
   c) SONNEBORN "Sonolastic SL 1"
   d) VULKEM "#45"

i. Multi-Component Pourable Self-Leveling Urethane Sealant (Fast Curing):
1) PECORA "Urexpan NR-200"
2) Acceptable alternative manufacturers:
   a) BONDAFLEX "Pur 2 SL"
   b) SIKA "Sikaflex 2c SL"
   c) SONNEBORN "Sonolastic SL 2"
   d) VULKEM "#245/255"

j. Acrylic-Emulsion Sealant:
1) PECORA "AC-20"
2) Acceptable alternative manufacturers:
   a) BONDAFLEX "Sil-A 700"
   b) SONNEBORN "Sonolac"

k. One-Part Butyl Sealant:
1) PECORA "BC-158"
2) Acceptable alternative manufacturers:
   a) PTI (by H.B. FULLER) "#707"

l. Acoustical Sealant:
1) PECORA:
   a) Exposed and Fire Rated areas; Pecora"AC-20 FTR"
   b) Concealed areas: Pecora "AIS-919"
2) Acceptable alternative manufacturers:
   a) BONDAFLEX "Sil-A 700"
   b) OSI "GRABBER" #GSCS
   c) TREMCO INC. 834
   d) W.W. HENRY "#413"

m. Firestop Sealants: Use in designated Fire-Rated Assemblies in accordance with approved UL Classified Assemblies.
1) HILTI
2) Acceptable alternative manufacturers:

a) 3M
b) PECORA

n. Firestop Putty Pads: Use in Fire-Rated Assemblies where penetration holes are too large for caulk, in accordance with approved UL Classified assemblies:
1) HEVI-DUTY / NELSON "Putty Pads"

o. Glazing Tape Sealants:
1) Butyl Glazing Tape:
a) PECORA "Extru-Seal"
b) Acceptable alternative manufacturers:
c) TREMCO, INC. "440 Tape"
2) Butyl Pressure Glazing Tape:
a) PECORA "Dyna-Seal"

p. Pre-Compressed Foam Sealants:
1) EMSEAL CORP. "Emseal"

q. Sheet Caulking (Electrical Junction Box Sealers):
1) LOWRY "Electrical Box Sealer"
2) Acceptable alternative manufacturer:
a) TREMCO INC. "Sheet Caulking"

r. EIFS preformed paintable Urethane Tape:
1) SIKA "Sikaflex PUR" Tape System

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. General:
1. Compatibility: Provide sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
a. Colors: Provide color of exposed sealants to comply with the following:
1) Sealant colors shall match adjacent wall color.
2) Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

B. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants (Silicones, Urethanes, and Acrylics) that comply with ASTM C 920 "Specification for Elastomeric Joint Sealants," and other requirements indicated on each Elastomeric Joint Sealant listed, including those requirements referencing ASTM C 920 "Specification for Elastomeric Joint Sealants," classifications for Type, Grade, Class, and Uses.
1. Additional Movement Capability: Where additional movement capability is specified in Elastomeric Joint Sealant listed, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719 "Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)," to withstand the specified percentage change in the joint width existing at time of installation.

C. Acrylic-Emulsion Sealant: Provide product complying with ASTM C 834 "Specification for Latex Sealants," that accommodates joint movement of not more than 5 percent in both extension and compression for a total of 10 percent.

D. Butyl Sealant: Manufacturer's standard one-part, non-sag, solvent-release-curing, polymerized butyl sealant complying with ASTM C 1311 "Standard Specification for Solvent Release Sealants," and formulated with minimum of 75 percent solids to be nonstaining, paintable, and have a tack-free time of 24 hours or less.

E. Acoustical Sealant: Manufacturer's non-drying, non-bleeding and non-hardening butyl sealant complying with ASTM C 834 "Specification for Latex Sealants," and the following requirements:
   1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90 "Test method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements."
   2. For fire rated conditions, use an acoustical sealant that has at least Class II Flame Spread and Smoke Developed ratings in accordance with ASTM E-84 "Test method for Surface Burning Characteristics of Building Materials," as follows:
      a. Flame Spread Rating 53.
      b. Smoke Developed Rating 117.

F. Firestop Pillows / Bags: In accordance with UL Classified systems. Reusable, heat-expanding pillows / bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

G. Firestop Sealants: In accordance with ASTM E 814 "Specification for Latex Sealants," and ANSI/UL 1479 Classified systems.
   1. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
   2. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.3 ACCESSORIES

A. Tape: Manufacturer's standard, solvent-free, butyl-based tape sealant with a solids content of 100 percent formulated to be nonstaining, paintable, and nonmigrating in contact with nonporous surfaces with or without reinforcement thread to prevent stretch and packaged on rolls with a release paper on one side.

B. Pre-compressed Foam: Manufacturer's standard preformed, pre-compressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water repellent agent; factory-produced in pre-compressed sizes and in roll or stick form to fit joint widths indicated and to develop a watertight and airtight seal when compressed to the degree specified by manufacturer; and complying with the following requirements:
   1. Properties: Permanently elastic, mildew-resistant, nonmigratory, nonstaining, and compatible with joint substrates and other sealants.
   2. Impregnating Agent: Manufacturer's standard.
   3. Density: Manufacturer's standard.
   4. Backing: Pressure-sensitive adhesive factory applied to one side with protective wrapping.

C. Backing Rods (Joint Sealant Backing):
   1. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
   2. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
      a. Open-cell polyurethane foam.
      b. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
      c. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
      d. Any material indicated above.

3. Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to -26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
4. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
5. Acoustical Sheet Caulking for junction boxes: LOWRY'S Electrical Box Sealer, or TREMCO INC. sheet caulking

D. Miscellaneous Materials:
1. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.
2. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.
3. Masking Tape: Non-staining, nonabsorbent material compatible with sealants and surfaces adjacent to joints. Use the type of masking tapes available that is compatible to the substrate being masked without damaging the surface material of finish when removed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual which, affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing sealants to comply with recommendations of joint sealant manufacturer and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form release agents from concrete.
4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of sealants.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

1. Masking Tape: Use the appropriate masking tape (type selected to the substrate so as not to mar the surface it is protecting) where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

A. General:

1. Comply with joint sealant manufacturer's written installation instructions applicable to products and applications indicated, except where more stringent requirements apply. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 "Standard Guide for Use of Joint Sealants," for use of sealants as applicable to materials, applications, and conditions indicated.
    a. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 "Practice for Use of Sealants in Acoustical Applications," as applicable to materials, applications, and conditions indicated.
    b. Use Urethane Sealants at painted joints.
    c. Use Silicone Sealants at exposed, non-painted joints.
    d. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
        1) Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability
            a) Do not leave gaps between ends of joint fillers.
            b) Do not stretch, twist, puncture, or tear joint fillers.
            c) Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
        2) Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.
    e. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
        1) For normal moving joints not subject to traffic: Fill joints to a depth equal to 50% of joint width, but not less than 1/4" deep or more than 1/2" deep. In no case shall the applied sealant width exceed the sealant depth.
        2) Assure that the *bond line* surface is a minimum of 1/4" wide. Install approved backer material at a proper depth to provide sealant bead profiles as detailed on approved shop drawings. Backer material shall be of appropriate size and shape and shall be compressed between 25% and 50% when installed.
        3) Backer material may not be modified in-lieu of using the properly dimensioned material. Install, when required a polyethylene, or other approved, bond backer tape to provide sealant bead profiles as detailed on approved shop drawings.
    f. Do not allow sealants, primers, or other compounds to overflow, spill or migrate into voids of adjacent construction.

g. Remove excess sealant spillage promptly as this work progresses. Clean adjacent surfaces by recommended means to remove sealant, but not damage the surfaces. Remove all cartons and debris from the site as the work progresses and at the end of each work day. Joints shall be prepared and sealed on the same working day.

h. Tooling of Non-sag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
   1) Provide concave joint configuration per Figure 5A in ASTM C 1193 "Standard Guide for Use of Joint Sealants," unless otherwise indicated.
   2) Provide flush joint configuration, per Figure 5B in ASTM C 1193 "Standard Guide for Use of Joint Sealants," where indicated.
      a) Use masking tape to protect adjacent surfaces of recessed and tooled joints.
   3) Provide recessed joint configuration, per Figure 5C in ASTM C 1193 "Standard Guide for Use of Joint Sealants," of recess depth and at locations indicated.

i. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's written directions for installation methods, materials, and tools that produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's written recommendations.

j. Acoustical Sealant Applications:
   1) Provide acoustical sealant to form an airtight seal at all penetrations and perimeter of sound-rated partitions, floors and ceilings. Comply with requirements of specification section titled Gypsum Board. Use backer-rod where gaps to be sealed exceed 3/8 inches.
   2) Provide sheet caulking to seal the back and sides of all junction boxes (4 gang and smaller) recessed in acoustically-rated partitions.
   3) Provide acoustical sealant as a continuous bead along gypsum board face layer at all head and sill conditions of sound-rated partitions and around the perimeter of resilient ceilings.

k. Firestop Sealants: In accordance with applicable UL Classified numbers compatible with products provided.

3.4 CLEANING

A. Clean in accordance with Specification - PROJECT CLOSEOUT.
   1. Clean any soiled surfaces immediately.
   2. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated sealants immediately so that and installations with repaired areas are indistinguishable from original work.

3.6 SCHEDULES

A. Sealant Schedule:

B. Sealants: Description of joint construction and location where sealant is typically applied

1. One-Part Neutral Cure Silicone Sealant:
   a. Exterior and interior joints in vertical surfaces of concrete and masonry.
   b. Between concrete masonry and stone.
   c. Between metal and concrete, mortar, and stone.
   d. Interior and exterior perimeter joints of metal frames in exterior walls.
   e. Exterior overhead joints.
   f. Use the applicable sealant for continual immersion in water applications, such as swimming pools, fountains and cooling towers – USDA Approved.
2. One-Part Acid-Curing Silicone Sealant:
   a. Exposed joints within glazed curtain wall framing systems, skylight framing systems, and aluminum entrance framing systems, if applicable.
3. One-Part Mildew-Resistant Silicone Sealant:
   a. White Grout Joints: Provide white silicone sealant material to match adjacent white grout joints in interior joints in vertical surfaces of ceramic tile in toilet rooms, showers, and kitchens.
   b. Colored Grout Joints: Provide colored silicone sealant material to match adjacent colored grout joints in interior joints in vertical surfaces of ceramic tile in toilet rooms, showers, and kitchens.
4. One-Part Gun Grade Urethane Sealant:
   a. Exposed joints in pre-cast, masonry, window frame perimeters and similar types of construction joints.
5. Multi-Component Gun Grade Urethane Sealant:
   a. Control joints and window and door perimeters.
6. Multi-Component Gun Grade Urethane Sealant (Fast Curing):
   a. Plaza Decks.
7. One-Part or Multi-Component Gun Grade Urethane Sealant (Security Sealant):
   a. Control joints and window and door perimeters where sealant is exposed to physical abuse.
8. One-Part Pourable Self-Leveling Urethane Sealant:
   a. Exterior and interior joints in horizontal surfaces of concrete.
   b. Exterior and interior joints in horizontal surfaces between metal and concrete, mortar, stone, and masonry surfaces.
9. Multi-Component Pourable Self-Leveling Urethane Sealant (Fast Curing):
   a. For use when walking surfaces require use within 24 hours of application without damage to joint surfaces.
   b. Exterior and interior joints in horizontal surfaces of concrete.
10. Acrylic-Emulsion Sealant:
    a. Paintable joints for the following surfaces expected to receive field painting:
       1) Interior joints in vertical and overhead surfaces at perimeter of elevator door frames and door frames (not requiring security grade sealant).
       2) Interior joints in gypsum board, plaster, concrete, and concrete masonry.
       3) All other interior field paintable joints not indicated otherwise.
11. One-Part Butyl Sealant:
    a. Primarily used for glazing seals where little or no movement is expected.
12. Acoustical Sealant:
    a. Joints to control dust, air, smoke and sound transmission, including under all exterior wall sill plates placed on top of Cast-In-Place Concrete slabs.
13. Firestop Sealants:
    a. In fire-rated walls, compatible with wall ratings and in accordance with applicable penetration types in walls and floors, and in accordance with UL Classified numbers.

END OF SECTION

SECTION 08 11 00 – METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to fabricate and install all Custom Metal Door Panels and Metal Frame materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
      a. Fire-Rated and Smoke-Rated Assemblies.
   2. Provide all material, labor, equipment and services necessary to fabricate and install Temperature Rise Fire-Rated Assemblies.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 03 15 14 DRILLED ANCHORS
   4. 03 30 00 CAST-IN-PLACE CONCRETE
   5. 04 22 00 CONCRETE MASONRY UNITS
   6. 05 12 00 STEEL AND FABRICATIONS
   7. 06 10 00 ROUGH CARPENTRY
   8. 07 40 00 METAL PANELS
   9. 07 60 00 SHEET METAL
   10. 07 92 00 SEALANTS
   11. 08 14 16 WOOD DOORS
   12. 08 33 00 COILING DOORS
   13. 08 51 23 STEEL WINDOWS
   14. 08 70 00 HARDWARE
   15. 08 80 00 GLASS
   16. 09 22 16 METAL FRAMING
   17. 09 24 00 CEMENT PLASTER
   18. 09 29 00 GYPSUM BOARD
   19. 09 30 00 TILE
   20. 09 65 19 RESILIENT TILE
   21. 09 67 23 RESINOUS FLOORING
   22. 09 72 00 WALL COVERINGS
   23. 09 91 00 PAINTING
   24. 10 05 00 MISCELLANEOUS SPECIALTIES
   25. 10 14 00 IDENTIFYING DEVICES
   26. 12 24 13 SHADES
   27. SPECIFICATION SECTIONS IN THE FACILITY SERVICE SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with the following standards:
      a. ANSI American National Standards Institute
      b. ASTM American Society of Testing and Materials
      c. AWS American Welding Society
      d. HMMA Hollow Metal Manufacturers Association (Division of NAAMM)
      e. NAAMM National Association of Architectural Metal Manufacturers
      f. NFPA National Fire Protection Association

g. NILECJ National Institute of Law Enforcement and Criminal Justice
h. UL Underwriter's Laboratory, Inc.
i. USSG U.S. Standard Gages
j. WH Warnock Hersey International

1.3 DEFINITIONS

A. Minimum Thickness: Base metal thickness without coatings.
B. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI / NAAMM-HMMA.
C. Glazing Molding: Portion of the assembly retaining glazing materials or in-fill panels in a hollow metal door which contain the integral glazing stop, or to which a glazing stop is attached.
D. Glazing Stop: A formed metal section used to secure glazing in a door or frame.
E. Prepared Opening: Existing opening or wall constructed prior to installation of frames.

1.4 SYSTEM DESCRIPTION

A. Design Requirements:
1. Metal Door and Frame Assemblies.
a. All Doors shall be custom in accordance to NAAMM-HMMA Standards for Hollow Metal Doors.
b. All Frames shall be custom in accordance to NAAMM-HMMA Standards for Hollow Metal Frames.
2. Fire Rated Assemblies:
a. Door and Frame Assemblies shall be custom in accordance to NAAMM-HMMA Standards for Fire-Rated Hollow Metal Doors and Frames and shall comply with all of the requirements for Doors and Frames.
b. Conform to the requirements of CBC, Chapter 7 "Fire and Smoke Protection Features".
1) Fire-Rated Door Assemblies shall comply with NFPA 252 "Standard Methods of Fire Tests of Door Assemblies" and UL 10C "Positive Pressure Fire Tests for Door Assemblies."
2) Fire-Rated Window Assemblies shall comply with NFPA 257 "Fire Testes for Fire Window Assemblies and Glass Block Assemblies," NFPA 80 "Standard for Fire Doors and Other Opening Protectives," and UL 9 "Fire Tests of Window Assemblies."
3) Fire-Rated Door Assemblies shall also meet the requirements for a Smoke and Draft Control Door Assembly, complying with UL 1784 "Air Leakage Tests for Door Assemblies."
4) Fire-Rated Doors and Frames shall be labeled by an DSA/FLS approved agency and shall comply with NFPA 80 "Standard for Fire Doors and Other Opening Protectives" and UL 1784 "Air Leakage Test for Door Assemblies."
c. All Fire-Rated Doors are to be positive latching and self or automatic closing in accordance with NFPA 80 "Standard for Fire Doors and Other Opening Protectives."
d. All Fire-Rated Assemblies shall be provided with approved gasketing material, so installed as to provide a seal where the door meets the stop on both sides and across the top.
1) Continuous Hinges, Seals, etc. shall not obscure ratings of doors or door frames.

1.5 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES.
   1. Contractor shall check all drawings and verify all dimensions (including wall thickness) in the field prior to fabrication.
   2. Contractor shall verify that shop drawings include all required materials and material clearances.

B. Product Data:
   1. Include construction details, material descriptions, core descriptions, label compliance, fire-resistance ratings, temperature-rise ratings, and finishes for each type of product indicated.
      a. Provide information indicating all the Structural Properties of the steel materials.

C. Shop Drawings:
   1. Include, but not limited to, the following information:
      a. Elevations of each door design and frame configuration.
      b. Details of doors, including vertical and horizontal edge details.
      c. Frame details for each frame type, including dimensioned profiles.
      d. Details and location of reinforcement and preparations for hardware.
      e. Details of each different wall opening condition.
      f. Details of anchorages, joints, field splices, and connection.
      g. Details of accessories.
      h. Details of moldings, removable stops, and glazing.
      i. Details of louvers, including sizes and location in doors, where required.
      j. Details of conduit and preparations for power, signal, and control systems.
   2. Provide a Schedule, prepared by or under the supervision of supplier for doors, panels, and frames using same reference numbers for details and openings as those on the Drawings.
      a. Coordinate with door hardware schedule.
   3. Provide setting drawings, templates, and directions for installing anchorage, including sleeves, concrete inserts, anchors, bolts, and items with integral anchors for installation coordination.
   4. Manufacturer's printed instructions for preparation, installation and care requirements for installers and inspecting authorities.

D. Samples:
   1. When factory applied color is indicated, provide manufacturer’s full range of factory applied color finishes for selection.
   2. Provide typical frame joint section and sample showing typical edge condition specified.
   3. When Stainless Steel is indicated, provide samples of 3 inches by 5 inches for each type of exposed finish required.
      a. Frames: Provide fabrication samples of profile and corner joints.
      b. Doors: Provide fabrication sample of corner showing vertical edges and top.

E. Quality Assurance/Control Submittals:
   1. Design Data:
   2. Test Reports:
      a. Product Test Reports based on evaluation of comprehensive test performed by a qualified testing agency, for each type of fire-rated metal door, panel, and frame assembly.
      b. Water Tightness Test Reports.
   3. Certificates:
      a. Oversized Construction Certification.
      b. Installer Certification for Temperature Rise Fire Rated Framing System.

F. Closeout Submittals in accordance with the following:
   1. General Construction Warranty.
   2. Workmanship and Materials Warranty.

1.6 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

C. Coordinate locations of door glazing with door hardware items.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Material Qualifications:
   a. Fire-Rated Door and Frame Assemblies shall be labeled by an DSA/FLS approved agency and shall comply with NFPA 80 "Standard for Fire Doors and Other Opening Protectives" and UL 1784 "Air Leakage Test for Door Assemblies."
   b. Oversized Door Assemblies required to be fire rated and exceeds the limitations of labeled assemblies, a certificate of inspection shall be furnished by an approved testing agency in lieu of an Oversized Fire Door Label.
2. Installer Qualifications:
   a. Installer shall be experienced and shall have successfully completed three (3) projects of similar scope and size to that indicated for this Project.
   b. Installer(s) shall have participated in mock-up installation that was successfully tested for water tightness.
3. Manufacturer/Supplier Qualifications:
   a. Manufacturer/Supplier shall have successfully produced/supplied products similar to that required for this Project, and shall have sufficient production/supply capacity to produce/supply required units without causing delay in the work.
   b. Manufacturers must be members of the HMMA, who have been engaged for at least two years in the production for sale of swing steel doors and frames on a national basis.
      1) All doors and frames shall be manufactured and supplied by the same manufacturer.
   c. Manufacturer/Supplier of Temperature Rise Fire Rated Framing System shall provide experienced mechanics familiar with this type of specialized work.

B. In accordance with Specification Section - Regulatory Requirements.

C. Certifications:

1. Oversized Construction Certification for Fire-Rated Door Assemblies shall state that the door conforms to the requirements of the design, materials and construction, but has not been subjected to the fire test.
2. Manufacturer of Temperature Rise Fire-Rated Framing System shall certify the Installer, in writing, as qualified to install manufacturer's systems in accordance with manufacturer's warranty requirements.

D. Mock Ups:

1. Provide Mock-Ups prior to application of the final layer of the finished exterior wall material and prior to installation of any exterior wall cavity and interior materials.
2. Metal Frame Assembly:
   a. Mock-Ups shall be of each type of opening assembly in every type of exterior wall assembly in which an opening occurs, shall integrate all other related work assemblies and shall be representative of the intended end use configuration.
      1) Provide a Mock-Up with a minimum opening size of 24 inches square for window opening.
   b. Mock Ups will be used for establishing construction sequence, and installation requirements of materials, and creating water tight assemblies.

c. Mock-Ups may become part of the completed Work upon successful testing for water tightness.

3. Installation:
   a. The Project Inspector, the Architect, Contractor's Superintendent and Sub-contactor's Superintendent shall observe the installation of materials.
   b. Installation crew for the Mock-Ups shall be the installers of the metal frame systems for this project and installers, as necessary, of other related work assemblies.
   c. Mock Ups shall include the installation of integral flashing, glazing, louvers, sheet metal flashing, sealants, water barriers and penetration flashing of exterior material systems and other materials of related work that makes the openings watertight.
   d. Failed Mock Ups shall be removed and the assembly reinstalled until the water tightness test is successful.

E. Meetings:
1. Pre-Installation: Scheduled by Contractor prior to the start of work.
   a. Coordinate the work with all other related work.
   b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
   a. Review for proper installation of work progress.
   b. Identify any installation problems and acceptable corrective measures.
   c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
   a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
   b. Establish protection procedures to maintain installed work until the Notice of Substantial Completion has been executed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
1. Doors and Frames shall be palletized, wrapped, or crated to provide protection during transit and Project-Site storage. Do not use non-vented plastic.
   a. Provide additional protection to prevent dents, scratches and other damage.

B. Acceptance at Site:
1. Do not deliver doors and frames to project site until Installer is ready and the site conditions will accommodate the installation of frames.
2. Damaged products will not be accepted.

C. Storage and Protection:
1. Storage and protection shall be in accordance with NAAMM-HMMA 840 Standard, "Installation and Storage of Hollow Metal Doors and Frames."
2. Store Doors and Frames under cover at Project Site. Stored on level platforms, minimum six (6) inches above ground, allowing air circulation under stacked units.
   a. Doors and Frames shall be placed in the up-right position, spaced by blocking to allow ventilation between units.
   b. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.9 PROJECT CONDITIONS

A. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.
    a. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions for the fabrication of custom frames. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.10 WARRANTY

A. Contractor's General Warranty:
    1. In accordance with Specification Section - WARRANTIES.
B. Manufacturer's Warranty:
    1. Doors and Frames in accordance with manufacturer's written standard warranty:
        a. Warranty Period One (1) Year.
    2. Provide the Temperature Rise Rated Framing system warranty against defective workmanship and materials.
        a. Warranty Period Five (5) years upon project completion and acceptance.
C. Installer's Warranty:
    1. Issue to the Owner a warranty against defective workmanship and materials.
        a. Warranty period Four (4) Years.
        b. In accordance with the terms of the Specification Section - WARRANTIES.
        c. Warranty shall include the responsibility for the repairs of any failure that is the result of defects in materials and workmanship.
        d. Warranty shall certify that the installation of all exterior Metal Doors and Frames were done in accordance with the method and procedures established with the successful Mock-Up for water tightness.
        e. The Warranty shall be co-endorsed by the General Contractor, the Metal Door and Frame Material Manufacturer, the Metal Door and Frame Installer and Glazing Installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
    1. Custom Metal Doors and Frames:
        a. SECURITY METAL PRODUCTS CORPORATION.
        b. Acceptable alternative manufacturers:
            1) CURRIES COMPANY.
            2) METAL MANUFACTURING CO., INC.
            3) STILES CUSTOM METAL, INC.
B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: Commercial Steel (CS), Type B, conforming with ASTM A 1008/A 1008M "Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable." Steel shall be suitable for exposed to view applications.

B. Hot-Rolled Steel Sheet: Commercial Steel (CS), Type B, conforming with ASTM A 1011/A 1011M "Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength." The steel shall be pickled and oiled, free of scale, pitting, coil-breaks or other surface defects.

C. Metallic-Coated Steel Sheet: Commercial Steel (CS), Type B, complying with ASTM A 653/A 653M "Standard Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process." The steel shall have a minimum G60 (Z180) zinc (galvanized) or A60 (ZF 180) zinc-iron-alloy (galvannealed) coating designation.

D. Stainless Steel Sheet: Complying with ASTM A 666 "Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar."

E. Inserts, Bolts and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M "Standard Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware."

F. Grout:

1. Masonry Walls: Mortar comply with Specification Section - CONCRETE MASONRY UNITS.

G. Insulation:

1. Mineral-Fiber Insulation: ASTM C 665 "Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing," Type I (blankets without membrane facing): consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density: with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 "Test method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C," for combustion characteristics.
   a. Fire Rated Doors and Frames: Provide insulation that provides fire protection and/or temperature rise ratings as indicated.
2. Expanded Foam Insulation suitable for injection into frame cavity.
   a. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
3. Exterior Doors: Provide core with thermal polyisocyanurate insulation cores.
4. Exterior Door Frames: Solidly packed mineral insulation.
5. Insulation for Miscellaneous work:
   a. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

I. Sealants: Comply with Specification Section – SEALANTS.

1. Sealants shall be compatible with glazing and frames.

2.3 MANUFACTURED UNITS

A. General:

1. Exterior Doors and Frames: In accordance with NAAMM-HMMA Standard 862, "Guide Specifications for Commercial Security Hollow Metal Doors and Frames," Class IV Door in accordance with NILECJ-STD-0306.00.
2. Interior Doors and Frames: In accordance with NAAMM-HMMA 861 Standard, "Guide Specifications for Commercial Hollow Metal Doors and Frames," unless otherwise indicated in the Contract Documents.

B. Doors:

1. Design shall be custom seamless hollow construction in the flush type variations as indicated.
   a. Thickness1-3/4 inch.
2. Face Sheets:
   a. Exterior Doors shall be fabricated from Metallic-Coated Steel Sheets with zinc-iron-alloy (galvannealed) coating designation.
      1) Exterior Doors 14 gage minimum.
   b. Interior Doors shall be fabricated from Cold-Rolled Steel Sheets.
      1) Interior Doors 18 gage minimum.
3. Core:
   a. Steel Stiffened with continuous vertical formed steel sections fabricated from same materials as face sheets.
      1) Exterior Door 18 gage minimum.
      2) Interior Door 22 gage minimum.
   b. Spaces between stiffeners shall be insulated the full height of the door.
4. Top and Bottom Edges:
   a. Close with continuous recessed and flush filler channels fabricated from same material as face sheets.
      1) Exterior Door 12 gage minimum.
      2) Interior Door 16 gage minimum.
   b. All doors shall have an additional flush filler channel at top and flush filler channel at bottom edges, unless recess channel at bottom is required for hardware.
   c. All channels shall be fabricated from same material as face sheets.
5. Jamb Edges:
   a. Reinforce with continuous "U" channels fabricated from same material as face sheets.
      1) Exterior Door 12 gage minimum.
      2) Interior Door 16 gage minimum.
   b. All channels shall be galvanized at exterior doors.
   c. Astragals shall be fabricated from same material as face sheets. 14-gage minimum.
6. Hardware Reinforcements:
   a. Exterior Doors: Reinforcing Plates shall be fabricated from the same material as the face sheets in the minimum thickness as follows:
      1) Hinges and Pivots 1/4" plate.
      2) Continuous hinges 14-gage.
      3) Mortise Hardware 7-gage.
      4) Locks, Exit Devices, Flush Bolts, Concealed Holders, Concealed Hardware or Surface-Mounted Closures 12-gage.
      5) Pull Plates, Bars and all other Surface-Mounted Hardware 12-gage.
   b. Interior Doors: Reinforcing Plates shall be fabricated from the same material as the face sheets in the minimum thickness as follows:
      1) Hinges and Pivots 7-gage.
      2) Continuous Hinges14-gage.
      3) Mortise Hardware 10-gage.
      4) Locks, Exit Devices, Flush Bolts, Concealed Holders, Concealed Hardware or Surface-Mounted Closures 12-gage.
      5) Pull Plates, Bars and all other Surface-Mounted Hardware 16-gage.
7. Glazing Moldings and Stops:
   a. Fabricate from the same material as the door face sheets.
      1) Exterior Doors 16-gage minimum.
      2) Interior Doors 20-gage minimum.
8. Door Louvers: In accordance with NAAMM-HMMA Standard 810 "Hollow Metal Doors" and fabricate from the same material as the door face sheets.

a. Exterior Doors:
   1) Internal Channels 12-gage minimum.
   2) Vanes 12-gage minimum.
      a) Reinforcement 0.25inch x 1.5 inch minimum.
   3) Insect Screens 12-gage minimum.
b. Interior Doors:
   1) Internal Channels 16-gage minimum.
   2) Vanes 18-gage minimum.
      a) Reinforcement 0.25inch x 1.5 inch minimum.
c. Fire-Rated Doors:
   1) Movable vanes closed by actuation fusible link and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated.
d. Non-Rated Doors: Provide sightproof louver of stationary vanes of inverted "Y" Type blade construction with a 30 percent free area, unless noted otherwise.

C. Panels:
1. Metal Panels shall be made of the same materials, construction and finishes complying with all requirements for Metal Doors.
2. Attachment:
   a. Attach securely to frame with concealed anchorage and machine screws.
   b. Attachment including screws shall be fully concealed when door is closed.

D. Frames:
1. Design shall be custom seamless hollow construction in the variety of configurations as indicated.
2. Exterior Frames shall be fabricated from Metallic-Coated Steel Sheets with zinc-iron-alloy (galvannealed) coating designation.
   a. All Opening sizes 12-gage minimum.
3. Interior Frames shall be fabricated from Cold-Rolled Steel Sheets.
   a. Openings 4'-0" or less 16-gage minimum.
   b. Openings greater than 4'-0" 14-gage minimum.
4. Glazing Stops shall be fabricate from the same material as Frames.
   a. Exterior Frames 16-gage minimum.
   b. Interior Frames 20-gage minimum.
5. Internal Frame Stiffeners shall be fabricated from the same material as Frames.
   a. Head of Frames 12-gage.
6. Internal Reinforcing Tabs shall be fabricate from the same material and gage thickness as Frame.
7. Hardware Reinforcements:
   a. Exterior Frames: Reinforcing Plates shall be fabricated from the same material as the Frame in the minimum thickness as follows:
      1) Hinges and Pivots 1/4" plate full width of frame x 10".
      2) Continuous Hinges 14-gage full width of frame x entire frame length.
      3) Strike Hardware 7-gage.
      4) Flush Bolts 7-gage.
      5) Closers 7-gage.
      6) Surface-Mounted Hardware 7-gage.
      7) Hold-Open Arms 7-gage.
      8) Surface Panic Devices 7-gage.
   b. Interior Frames: Reinforcing Plates shall be fabricated from the same material as the Frame in the minimum thickness as follows:
      1) Hinges and Pivots 7-gage full width of frame x 10".
      2) Continuous Hinges 14-gage full width of frame x entire frame length.
      3) Strike Hardware 12-gage.
      4) Flush Bolts 12-gage.
      5) Closers 12-gage.

6) Surface-Mounted Hardware 12-gage.
7) Hold-Open Arms 12-gage.
8) Surface Panic Devices 12-gage.

8. Grout Guards: Grout Guards shall be fabricated from the same material as the Frame in minimum 22-gage thickness.

E. Frame Anchors:
1. Exterior Frames: Frame Anchors shall be fabricated from Metallic-Coated Steel Sheets, unless indicated otherwise.
a. Masonry Wall not less that 2" wide x 10" long Anchors.
1) Non Grouted Frames 14 gage T-Strap Anchors.
2) Grouted Frames 14-gage perforated Adjustable Strap & Stirrup Anchors.
a) Wire Loop Anchors of 0.156" diameter steel wire may be used at non-fire-rated frames that are fully grouted.
b. Concrete Walls 14-gage Pour In Place Anchors.
c. Stud Frame Walls 16-gage Combination Steel Stud Anchors.
1) Anchor shall be not less than 2" wide x 10" long.
d. Jamb Base 14-gage Fixed Floor Anchors.
e. Floor Base 14-gage Existing Wall Anchors.
1) Where indicated 14 gage continuous Rough Buck Anchors.
f. Prepared Openings 14-gage Existing Wall Anchors.
1) Where indicated 14 gage continuous Rough Buck Anchors.
2. Interior Frames: Frame Anchors shall be fabricated from Cold-Rolled Steel Sheets or Hot-Rolled Steel Sheets, unless indicated otherwise.
a. Masonry Wall not less that 2" wide x 10" long Anchors.
1) Non Grouted Frames 16 gage T-Strap Anchors.
2) Grouted Frames 16 gage perforated Adjustable Strap & Stirrup Anchors.
a) Wire Loop Anchors of 0.156" diameter steel wire may be used at non-fire-rated frames that are fully grouted.
b. Concrete Walls 16 gage Pour In Place Anchors.
c. Metal Stud Frame Walls 18-gage Metal Channel Stud Anchors.
d. Jamb Base 14-gage Fixed or Adjustable Floor Anchors.
e. Floor Base 16 gage Existing Wall Anchors.
1) Where indicated 16 gage Fixed Mullion Anchors.
f. Prepared Openings 16-gage Existing Wall Anchors.
1) Where indicated 16 gage continuous Rough Buck Anchors.

F. Fasteners:
1. Screws, bolts, washers, shields, spacers and other similar fastening devices:
a. Provide stainless steel vandal resistant screws when outside exterior face glass stops are indicated.
b. Furnish and install as required by frame installer.
c. Provide Stainless Steel fasteners at Stainless Steel Frames.

2.4 FABRICATION

A. Shop Assembly:
1. General:
a. Fabricate in accordance NAAMM-HMMA Standard 810 "Hollow Metal Doors" and NAAMM-HMMA Standard 820 "Hollow Metal Frames," and NAAM-HMMA Standard 850 "Fire-Rated Hollow Metal Doors and Frames."
b. Fabricate to the required size and profiles by accurately forming, welding edges straight, sharp and true. Corner bends shall be true and straight and of minimum radius for the gage of metal used.

c. All finish work shall be strong, rigid and neat in appearance with corners, hairline joints and surfaces free from warp, wave, buckle, tool marks, surface imperfections or other defects.

d. Welding to conform to applicable standards of AWS for high grade finished metal fabrication. All exposed welds shall be ground, filled and dressed smooth with no voids, tool marks, surface imperfections or ridges showing to make them invisible and provide a smooth flush surface.

e. Assemblies shall be shop fabricated and permanently assembled before shipment.
   1) Where shipping limitations so dictate, frames for large openings shall be fabricated and prepared in section designated for assembly in the field and clearly identified.

2. Metal Door Fabrication:
   a. General: All doors shall be of the types and sizes required and shall be fully welded seamless construction with smooth surfaces without visible joints of seams on exposed faces or edges.
      1) Glazed Lites shall be factory cut openings in doors.
      2) Provide weep-hole openings in the bottom of exterior doors to permit the escape of entrapped moisture.
   b. Face Sheets: Door faces shall be joined at their vertical edges by a continuous weld extending the full height of the door.
   c. Core: Stiffeners shall extending full-door height and spanning the full thickness of the interior space between door faces.
      1) Space Stiffeners no more than 6" apart and securely attached to both face sheets by spot welds spaced a maximum of 5" o.c..
      2) Solidly pack cavities the entire height of door with mineral-fiber insulation.
         a) Fire Door Cores: As required to provide fire-protection and temperature-rise ratings as indicated.
   d. Top and Bottom Edges: Closing Channels shall extend the full width of the door at top and bottom edges.
      1) All doors shall have recessed Closing Channels, spot welded to both faces. When left exposed, fill all gaps with epoxy sealer and filler, sand smooth with no tool marks or surface imperfections.
      2) All doors shall have flush-filler Closing Channels in addition to recessed Closing Channels. Channels shall be continuously welded and ground smooth with no marks at all doors.
         a) Flush-filler Closing Channel shall be omitted at bottom edge when recess channel is required for hardware.
   e. Jamb Edges: Reinforcing Channels shall extend the full height of the door.
      1) Edge profiles shall be provided on both vertical edges of doors as follows:
         a) Single-Acting Swing Doors beveled 1/8" in 2".
         b) Double-Acting Swing Doors rounded on 2-1/8" radius.
      2) Astragal: Flat x 1-1/2 inch, continuous welded to panel, ground smooth with no tool marks or surface imperfections. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
         a) Provide overlapping astragal on one leaf of pairs of doors where required for fire-performance rating or where indicated.
         b) At exterior doors, provide overlapping astragal at strike. Cope astragal around strike plate.
   f. Hardware Reinforcements: Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only, in accordance with the approved hardware schedule and templates provided by the hardware contractor.
      1) Where surface-mounted hardware is to be applied, doors shall have reinforcing plates only under the face of door.

g. Glazing Moldings and Stops: Provide glazing moldings and stops to secure glazing material and louvers. Moldings and stops shall be flush with face sheets of door. Use the same trim profile on all Fire-Rated and Non Fire-Rated Openings.
   1) Fixed Glazing Moldings shall be securely welded to both face sheets of door.
   2) Removable Glazing Stops shall be channel shaped and have mitered hairline corner joints. Drill and dimple stop for countersinking and concealment of fasteners spaces equally at 9" o.c. maximum and a maximum of 2" from ends. Snap-on attachments will not be permitted.
   3) Metal surfaces underneath the glazing stops and the inside of the glazing stops shall be treated for maximum paint adhesion and painted with a with a rust inhibitive primer prior to installation in the door.
   4) Coordinate depth and rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

h. Louvers: Flush opening with all welded construction.
   1) Internal channels securely welded to the inside of both face sheets of door.
   2) Provide vertical reinforcement at midpoint when louver width exceeds 18" inches.

3. Metal Panel Fabrication: Comply with all requirements for Metal Doors.
   a. Attach securely to frame with concealed anchorage and machine screws.
      1) Attachment, including screws, shall be fully concealed when door is closed.
4. Metal Frame Fabrication:
   a. General: All frames shall be welded units of the sizes and profiles indicated and shall be of seamless hollow construction with smooth surfaces without visible joints of seams on exposed faces or edges.
      1) Metal Frame Spreaders shall be temporarily attached at bottom of all open frames for shipping and storage.
   b. Frame Sections: All frames are to be rolled and brake formed with integral nailing flanges, back bends, faces, rabbits, stops, and soffits, unless indicated otherwise.
      1) Provide 3 ½ inch wide integral Nailing Flanges at exterior frames. The flange shall be continuous all around the frame at head, jambs and wall sills without gaps at the corner joints. Coordinate flange length with height of concrete curb.
      2) Punch and Dimple frames at attachment points for countersinking and concealment of all through the frame anchorage fasteners.
   c. Frame Joints:
      1) Perimeter Corners: Head, Jamb and Wall Sills Members shall be saw-mitered and fully (continuously) welded along entire joint from the throat or the unexposed side at Flanges, Returns, Faces, Rabbet, Stops, and Soffits.
      2) Perimeter Butts: Entire joint shall be fully (continuously) welded along entire joint at Flanges, Returns, Faces, Rabbet, Stops, and Soffits from the throat or the unexposed side of the frame.
         a) Interior Frames: Continuously weld only the Faces. Rabbits, Stops and Soffits shall to be tightly fitted and appear as a hairline seams.
         b) Vertical Mullions members shall extend through Floor Sill Members to floor. Floor Sill Members Stops are to be notched.
      3) Internal Flush and Indented Butts: Vertical Mullions Members shall be continuous, butt to Head and Sill Members and extend through Horizontal Rail Members. Vertical Mullion Stops are to be notched at Head and Sill Members and the Horizontal Rail Stops are to be notched to Vertical Member. Continuously weld only the Faces.
         a) Exterior Frames: Body Putty continuously along entire joint at returns, rabbets, stops, and soffits creating a water tight joint. Sand flush and smooth with no voids or ridges.

b) Interior Frames: Rabbits, Stops and Soffits shall to be tightly fitted and appear as a hairline seams.

d. Alignment and Reinforcing Tabs: Provide internal alignment and reinforcing tabs at each joint of field splices with a minimum overlap of 2".

e. Internal Frame Stiffeners: Provide additional continuous steel "U" Channel extending the full width of frame and shall be factory welded into head of frame.
   1) Grouted Frames with openings greater than 4'-0" width.
   2) Frames with openings greater than 12'-0" in width.

f. Hardware Reinforcements: Frame shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only, in accordance with the approved hardware schedule and templates provided by the hardware contractor.
   1) Where surface-mounted hardware is to be applied, frames shall have reinforcing plates only under face of frame.

g. Grout Guards: Provide at all hardware preparations, tapped mounting holes, glazing stop screws, silencers, and electrical box preparations on frames that are to be grouted.
   1) Weld guards to inside of frame at throat.

h. Glazing Stops: Provide channel shaped removable Glazing Stops to secure glazing material or panels. Glazing Stops shall be continuous and have butted hairline corner joints.
   1) Coordinate stop depth and rabbit width between fixed and removable stops with type of glazing and type of installation indicated.
      a) Stop Depth 5/8" depth minimum.
   2) Drill and Dimple stops for countersinking and concealment of fasteners uniformly spaced at 9 inches o.c. maximum and not more that 2 inches maximum from each corner.
   3) Metal surfaces underneath the glazing stops and the inside of the glazing stops shall be treated for maximum paint adhesion and painted with a with a rust inhibitive primer prior to installation in the door.

5. Frame Anchors:
   a. Coordinate the type of frame anchors with the type of frame insulation or grout being used so that the frame is fully packed with no voids.
   b. All Frame Anchors shall be securely welded to the throat at inside of frames.
   c. Frame Anchor Spacing: All Frame Anchors at head, jamb and sill shall be placed a maximum of 8" from frame corners, and ends, with the remainder of the anchors to be equally spaced, not to exceed a maximum of 24" o.c. for all walls types unless indicated otherwise.
      1) Masonry Walls: The spacing of anchors shall be equally spaced, not to exceed a maximum of 24" o.c.. Total number of anchors provided on each jamb shall be not less than the following:
         a) Frames up to 7'-6" height 4 anchors.
         b) Frames 7'-6" to 8'-0" height 5 anchors.
         c) Frames over 8'-0" height provide five (5) anchors plus one (1) additional anchor for each 2' -0" or fraction thereof in height over 8'-0".
      2) Stud Framed Walls: The spacing of anchors shall be equal spaced, not to exceed a maximum of 18" o.c.. Total number of anchors provided on each jamb shall be not less than the following:
         a) Frames up to 4'-0" height 4 anchors.
         b) Frames 4'-0" to 7'-6" high 5 anchors.
         c) Frames 7'-6" to 8'-0" height 6 anchors.
         d) Frames over 8'-0" height provide six (6) anchors plus one (1) additional anchor for each 2'-0" or fraction thereof in height over 8'-0".

3) Jamb Base: Provide floor anchors for each jamb and mullion that extends to floor.
   a) When conditions do not permit the use of a floor anchor, an additional jamb anchor shall be substituted at a location not to exceed 8" from the base of the jamb.
4) Floor Base: When conditions do not permit the use of Existing Wall Anchors at floor sill members, provide continuous rough buck for frame anchorage.

6. Rubber Door Silencers: Except on weather/sound strip or fire gasket doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single Swing Door Frames — Provide and install three (3) at strike jamb.
   b. Double Swing Door Frames — Provide and install four (4) at head.

B. Fabrication Tolerances:
1. General: Clearances and Tolerances shall be in accordance with NAAMM-HMMA Standard 862 for Exterior Assemblies and NAAMM-HMMA Standard 861 for Interior Assemblies.

2.5 FINISHES

A. Shop Priming:
1. After fabrication, all tool marks and surface imperfections shall be dressed, filled and sanded as required to make all faces and vertical edges smooth, level and free of all irregularities.
2. Clean and chemically treat (phosphatize) the metal to insure maximum paint adhesion in preparation for primer paint.
3. Apply rust-inhibitive primer paint to all surfaces, minimum dry thickness of 0.7 mils. Manufacturer to provide primer for prolonged exposure that are compatible with substrate and field-applied coatings.
   a. Coordinate primer used with field-applied paint finishes that are indicated and specified.
   b. Shop Primer shall not be considered as a substitution for any primer required as part of the field-applied paint finishes.
   c. Rust-inhibitive primer shall be fully cured before packaging and shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:
1. Prior to the installation of the work under this specification section, examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work under this specification section.
2. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
3. Report conditions detrimental to performance of the work under this specification section. Proceed with installation only after unsatisfactory conditions have been corrected.
4. Installation of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Protection:

1. Protect all adjacent surfaces from damage from work under this specification section.

B. Surface preparation:
   1. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling and dressing, as required to repair area smooth, flush and invisible on exposed faces.
   2. Prior to installation, All frames with temporary spreaders removed, shall be checked for size, and swing, and corrected to installation tolerance for squareness, alignment, twist and plumbness. Securely brace frames and maintain installation tolerances within the following limits.
      a. Opening Width: Plus 1/16 inch, minus 1/32 inch, measured from rabbet to rabbet at top, middle and bottom of frame.
      b. Opening Height: Plus 1/16 inch, minus 1/32 inch, measured measured vertically between the frame head rabbet and top of floor or bottom of frame minus jamb extension at each jamb and cross the head.
      c. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      d. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
      e. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines and perpendicular to plane of wall.
      f. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
   3. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General:
   1. Install metal doors and frames plumb, rigid, properly aligned and securely fastened in place; comply with NAAMM-HMMA Standard 840, "Installation and Storage of Hollow Metal Doors and Frames."
   2. Install in accordance with manufacturer's instructions and recommendations unless specifically noted otherwise.
   3. Install Fire-Rated and Smoke-Control Assemblies in accordance with NFPA 80 "Standard for Fire Doors and Other Opening Protectives" and NFPA 105 "Standard for the Installation of Smoke Door Assemblies and Other Openings."

B. Frames:
   1. Set frames accurately in position, plumbed, aligned, and temporarily braced secure, until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
      b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
         1) At exterior frames, Body Putty smooth entire joint continuously along returns, rabbets, stops, and soffits creating a watertight joint. Sand flush with no voids or ridges.
   2. Solidly insulate within the throat of all non-grouted exterior and interior frames for the full depth, width and length of frame.
      a. Provide fire-rated mineral fiber insulation as required to provide fire-protection and temperature-rise ratings as indicated at Fire Rated Assemblies.
      b. Inject expanding foam insulation as required.
   3. Jamb Base: Secure in place frame anchors to floor with post-installed expansion anchors.

4. Floor Base: Secure frames in place with post-installed expansion anchors to floor. Countersink fasteners, fill with body putty, sand smooth and flush with no voids or ridges. Conceal installed fasteners as to be invisible at exposed faces.
5. Masonry and Concrete Walls: Coordinate installation of frames to allow the solidly fill the space between frames and masonry or concrete with grout. Take precautions, grout in lifts and brace frames, to ensure that frames are not deformed or damaged by grout forces.
   a. Field apply bituminous coating to backs of all frames that are filled with grout.
   b. Install door silencers in frames before grouting.
6. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink fasteners, fill with body putty, sand smooth and flush with no voids or ridges. Conceal installed fasteners as to be invisible at exposed faces.
7. Stud Frame Walls: Secure frames in place with screw fasteners at frame anchors to wall framing.
8. In-Place Stud Frame Walls: Secure frames in place with screw fasteners at frame anchors to wall framing. Countersink fasteners, fill with body putty, sand smooth and flush with no voids or ridges. Conceal installed fasteners as to be invisible at exposed faces.
9. Frame and Wall Joints: Provide joint sealants to maintain watertight and airtight continuous seals that aesthetically join dissimilar materials without causing staining or deterioration of joint substrates. Application of sealants shall be in strict compliance with manufacturer's instructions.
   a. Provide integral color sealants at exterior joints and paintable sealants at interior joints.
   b. Clean out joint between frames and masonry or concrete to a depth of 3/4 inch. Fill with rod and sealants.
10. Field-apply compatible and paintable sealant at all frame joints that are exposed to the exterior for the full depth of the frame at returns, rabbits, stops and soffits.

C. Doors: Fit doors accurately in frames, within clearances specified below. Shim as necessary.
   1. Non-Fire-Rated Doors:
      a. Between door and frame at jambs and head 3/16 inch maximum.
      b. Between edges of pairs of doors 3/16 inch maximum.
      c. Door Sill Clearances: Coordinate with threshold conditions and floor materials.
         1) Between bottom of door and top of threshold 3/8 inch maximum.
         2) Between bottom of door and floor with no threshold 3/4 inch maximum.
   2. Fire-Rated and Smoke-Control Doors: Install doors with clearances according to NFPA 80 "Standard for Fire Doors and Other Opening Protectives" and NFPA 105 "Standard for the Installation of Smoke Door Assemblies and Other Openings."
      a. Between bottom of door and floor covering surface 1/2 inch maximum.

D. Glazing Stops:
   1. Coordinate and comply with installation requirements for all glazing indicated and specified.
   2. Secure Glazing Stops to frames and doors with corrosion resistant countersunk flat or oval-head machine screws.
      a. All exterior screws (head, jamb and sills) shall be attached with a bed of sealant at the penetration point into the frame for a positive seal against water intrusion.
      b. Countersink fasteners, fill with body putty, sand smooth and flush with no voids or ridges. Conceal installed fasteners as to be invisible at exposed faces.
   3. All exterior stops shall receive a full bed of sealant at back channel leg for the full length of opening, during final glazing installation for positive seal against water intrusion.
      a. Coordinate sealants with the requirements of the glazing specified.

3.4 FIELD QUALITY CONTROL

A. Site Tests:
   1. As required by Regulatory Requirements.
   2. Mock-Up Assemblies:
      a. Water Spray Test: Upon completion of the installation of the Mock-Up Assembly, conduct test for water penetration in according to AAMA 501.2 requirements.
         1) The Project Inspector, the Architect, Contractor's Superintendent and Sub-contractor's Superintendent shall visually inspect for water penetration.
         2) A Thermal Imagining process conducted by a Owner's Testing Laboratory Service, shall be used for additional inspection for water penetration.
         3) Cost of additional testing and inspection required due to failure for water tightness shall be borne by the Contractor.
      b. Reports:
         1) Project Inspector and/or Owner's Testing Laboratory Services shall provide a written report noting the installation and water tightness of the Mock-Up Assemblies tested.

B. Inspection:
   1. Notification: Schedule all inspections. Notify the Architect, Project Inspector and any regulatory agencies of the time at least 48 hours prior to the inspection.
   2. Regulatory Requirements: No work shall be excepted without the required inspections being performed.

3.5 ADJUSTING

A. Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operation condition. Coordinate with hardware suppliers for function and use.

B. Remove and replace defective work, including work that is warped, bowed, or other wise unacceptable.

3.6 CLEANING

A. Clean in accordance with Specification Section - TEMPORARY FACILITIES AND CONTROLS.
   1. Immediately clean all adjacent surfaces from all foreign materials.
   2. Immediately remove grout, sealants and any foreign materials from bonding to metal doors and frames.
   3. In accordance with manufacturer's instructions and recommendations.

B. Metal Doors and Frames finishes shall be clean and ready of application of any additional finishes after installation.
   1. Prime-Coat Surfaces: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
   2. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect and maintain conditions that ensures the work is without damage or deterioration until the time of Completion has been executed.
   1. Maintain in a manner acceptable to manufacturer's and installer's warranty.

END OF SECTION

SECTION 08 14 16 – WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all wood door materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 04 22 00 CONCRETE MASONRY UNITS
   4. 05 12 00 STEEL AND FABRICATIONS
   5. 07 60 00 SHEET METAL
   6. 07 92 00 SEALANTS
   7. 08 11 00 METAL DOORS AND FRAMES
   8. 08 34 73 ACOUSTICAL DOORS AND FRAMES
   9. 08 70 00 HARDWARE
   10. 08 80 00 GLASS
   11. 09 22 16 METAL FRAMING
   12. 09 24 00 CEMENT PLASTER
   13. 09 29 00 GYPSUM BOARD
   14. 09 91 00 PAINTING
   15. 10 14 00 IDENTIFYING DEVICES
   16. 10 26 00 WALL AND CORNER GUARDS
   17. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with the following standards:
      a. AWS "Architectural Woodwork Standards," Latest Edition, including latest amendments, by the Architectural Woodwork Institute, Architectural Woodwork Manufacturers Association of Canada, and the Woodwork Institute.
      b. BHMA Builders Hardware Manufacturers Association, Inc.
      c. CRSC California Referenced Standards Code, CCR, Part 12, Chapter 12-7-4 "FIRE-RESISTIVE STANDARDS - Fire Door Assembly Tests."
      d. NEMA National Electrical Manufacturers Association, LD-3, Latest Edition.
      e. NFPA National Fire Protection Association "Fire Doors and Windows" NFPA No. 80.
      f. UL Underwriter's Laboratories "Fire Tests of Door Assemblies" (UL 10 (b) - 1970).
      g. WDMA Window and Door Manufacturers Association.
      h. WDMA I.S. 1A-04 "Industry Standard for Architectural Wood Flush Doors."
      i. WI Woodwork Institute.

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product Data.

a. Submit manufacturer's literature describing products.

2. Shop Drawings.
   a. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loading, required clearances, method of field assembly, components, and location and size of each field connection.
   b. Compare doors with glass inserts with hardware templates. Indicate hardware that may coincide with glass.
   c. Submit door type, details and location with reference to Architect's door mark and hardware group.
   d. Samples.
   e. Provide samples of each door finish, in the species specified for the veneer.
3. Quality Assurance/Control Submittals:
   a. Test Reports:
      1) Submit four (4) copies of testing laboratory's report indicating any fire labels that may be required.
   b. Manufacturer's Written Instructions:
      1) Submit three (3) copies of manufacturer's written instructions.
   c. Certificates:
      1) Submit three (3) copies of certificates.
         a) Before delivery to the jobsite, the Wood Door supplier shall issue a WI CERTIFIED COMPLIANCE CERTIFICATE indicating the Wood Door products to be furnished for this project shall meet fully all the requirements of the grade or grades specified.
         b) Upon completion of installation, a WI CERTIFIED COMPLIANCE CERTIFICATE shall be furnished for the installation.
         c) Submit three (3) copies of a letter on Contractor's Letterhead certifying work provided, meets or exceeds, the requirements of this Section.
4. Closeout Submittals in accordance with the following:
   a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
   b. Warranty in accordance with Specification Section - WARRANTIES.

1.4 COORDINATION

A. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

B. Coordinate locations of door glass inserts with door hardware items.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
      b. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
   2. Manufacturer/Supplier Qualifications:
      a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
   3. Testing Agency Qualifications:

a. Testing Agency shall be approved and recognized by enforcing agency and provide inspection of materials and workmanship during fabrication and assembly.

B. In accordance with Specification Section - REGULATORY REQUIREMENTS.

C. Meetings:

1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
   a. Coordinate the work with other work being performed.
   b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
   a. Review for proper installation of work progress.
   b. Identify any installation problems and acceptable corrective measures.
   c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
   a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
   b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:

1. Products shall be individually wrapped.
2. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:

1. Products must be in manufacturer's original unopened containers with labels (including any fire labels) indicating brand name, model, and grade.
2. Damaged products will not be accepted.

C. Storage and protection:

1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
   a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.7 PROJECT CONDITIONS

A. Environmental requirements:

1. Temperature: Maintain ambient temperature in space to receive products between sixty (60) degrees Fahrenheit and ninety (90) degrees Fahrenheit for seven (7) days prior, during, and seven (7) days minimum following installation. Inform the Owner of ambient temperature requirements for products installed and maintain until Substantial Completion and turn-over of the building or facility to the Owner.
2. Humidity: Maintain humidity in space to receive products between 25 percent to 55 percent at 60 degrees F to 90 degrees F, and EMU (Equilibrium Moisture Content) conditions between 6 percent to 8 percent for four (4) days minimum prior, during, and following installation in accordance with manufacturer's written recommendations. Inform the Owner of humidity requirements for products installed and maintain until Substantial Completion and turn-over of the building or facility to the Owner.

B. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

1.8 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written materials standard warranty:
      a. Warranty Period Life of Installation.
         1) Doors shall be warranted for life of installation against warp or twist in excess of 1/4" in any face including full diagonal.
         2) Replacement shall include finishing of new replacement door, hardware damaged by malfunction of original door, and hanging in satisfactory operating condition.

C. Installer's Warranty:
   1. In accordance with the terms of the Specification Section - WARRANTIES:
      a. Warranty period Five (5) years.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Wood Doors:
   1. Performance Duty Level: Extra Heavy Duty per ANSI /WDMA I.S.1A.
   2. Acoustical Performance:
      a. Typical Wood Door Assemblies: STC 30 min.
      b. Sound Wood Door Assemblies: STC 35 min.
   3. Pre-finished Wood Veneer, 1-3/4" Solid Core, with stain grade wood veneer faced doors, WI Premium Grade.
      a. Standard: Manufactured in accordance with Commercial Standards as amended and recognized by the AWS.
      b. Core:
         1) Non-Rated Solid Core Doors:
            a) 5-ply particle board core bonded under pressure to stiles and rails.
         2) Fire-Rated Solid Core Doors:
            a) Mineral composition core meeting requirements of specified standards.
      c. Face Veneers:
         1) AWS **White Maple** plain sliced, with slip-matched veneer panels faces suitable for transparent finish.
         2) Pairs of doors shall be "Pair Matched."
      d. Edges:
         1) Same species of the face, sealed and matched for color with the face veneer.
      e. Finish:
         1) Premium Grade, clear System No. 5 (Catalyzed Polyurethane).

B. Hardware:
   1. Finish Hardware shall be furnished under Specification Section – HARDWARE.
      a. Coordinate the hardware templates with the Contractor for field fitting and installation into the doors.
   2. Doors shall be pre-fit in field and provided with cut outs for hardware according to templates and AWS.

2.2 FABRICATION

A. Shop Assembly:
   1. All doors marked for opening numbers shown on the drawings and with protective wrapping.
      a. Doors shall be Type I adhesive doors regardless of exposure.

2.3 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   1. Finish faces, top, bottom, hinge and latch edges, edges of cutouts, and mortises. Stains and fillers may be omitted on edges of cutouts, and mortises.
B. Finish doors at factory.
C. Finish doors at factory that are indicated to receive transparent finish.
D. Transparent Stained Finish:
   1. Grade: Premium.
   2. Staining: As selected by Architect from manufacturer's full range, including custom colors.
      a. Do not stain over fire labels.
   3. Finish: WI System No. 5 catalyzed polyurethane.
   4. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
   5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
   1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual, which affect the execution of work under this specification section.
   2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
   3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
   2. Examine opening and hardware schedules to verify proper coordination.
B. Protection:
   1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
C. Surface preparation:
   1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
   2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

3.3 INSTALLATION

A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.

B. Layout:
1. Lines shall be straight and true.

C. Non-Rated Doors:
1. Clearance at jambs and heads: 1/8-inch.
2. Per leaf clearance at meeting stiles for pairs of doors: 1/16-inch.
3. Clearance from bottom of door to top of decorative floor finish or covering: 1/8-inch.
4. Where threshold is shown or scheduled, provide 1/4-inch clearance from bottom of door to top of threshold.

D. Fire-Rated Doors:
1. Comply with NFPA 80 for fitting clearances for fire-rated doors.
   a. Threshold Clearances: Consistent Undercut.
      1) Door in fire-rated openings shall not be undercut more than is allowed by CRSC, CCR, Part 12, Chapter 12-7-4 "FIRE-RESISTIVE STANDARDS - "Fire Door Assembly Tests."
   b. Conform to the requirements, for assemblies and fire tested in accordance with CRSC, CCR, Part 12, Chapter 12-7-4 "FIRE-RESISTIVE STANDARDS - Fire Door Assembly Tests."
      1) All 20 minute rated assemblies shall be provided with approved gasketing material so installed as to provide a seal where the door meets the stop on both sides and across the top.
      2) All rated doors are to be positive latching and self-closing.
   c. Continuous Hinges shall not obscure rating of doors and frames.

E. Install all finish hardware in strict accordance with the manufacturers written recommendations, eliminating all hinge-bound conditions and making all items smoothly operating and firmly anchored into position.

3.4 REPAIR / RESTORATION

A. Defective Work:
1. Replace, rework or otherwise make good as required doors, finish, frames or hardware found broken, damaged, disfigured or defaced.
2. Incomplete, misaligned, or incorrectly located products will not be accepted.

3.5 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
1. Clean any soiled surfaces immediately.
2. Finish shall be clean and ready for the application of any additional finishes.
3. In accordance with manufacturer's written instructions and recommendations.

3.6 PROTECTION

A. Protection from traffic:
1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Completion.

END OF SECTION

SECTION 08 15 13 – LAMINATE-FACED WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all Laminate-Faced Wood Door materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 07 92 00 SEALANTS
   4. 08 11 00 METAL DOORS AND FRAMES
   5. 08 70 00 HARDWARE
   6. 08 80 00 GLASS
   7. 09 22 16 METAL FRAMING
   8. 09 91 00 PAINTING
   9. 10 26 00 WALL AND CORNER GUARDS
   10. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:

B. In accordance with the following standards:
   a. AWS Architectural Woodwork Standards, Section 9.
   b. BHMA Builders Hardware Manufacturers Association, Inc.
   c. DHI Door Hardware Institute.
   d. NEMA National Electrical Manufacturers Association, LD-3, Latest Edition.
   e. NFPA National Fire Protection Association, NFPA No. 80 "Fire Doors and Windows."
   f. WDMA Window and Door Manufacturers Association - 1A "Industry Standard for Architectural Wood Flush Doors."
   g. CRSC California Referenced Standards Code, CRSC 12-7-4, "Fire Door Assembly Tests."
   h. UL Underwriter's Laboratories "Fire Tests of Door Assemblies" (UL 10 (b)).

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product Data.
      a. Submit manufacturer's literature describing products.
   2. Shop Drawings.
      a. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loading, required clearances, method of field assembly, components, and location and size of each field connection.
      b. Submit door type, details and location with reference to Architect's door mark and hardware group.
   3. Samples.
      a. Provide samples of each door color, finish and pattern.

4. Quality Assurance/Control Submittals:
    a. Manufacturer's Written Instructions:
        1) Submit three (3) copies of manufacturer's written instructions.
5. Closeout Submittals in accordance with the following:
    a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
    b. Warranty in accordance with Specification Section - WARRANTIES.

1.4 COORDINATION

A. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.
B. Coordinate locations of door glazing with door hardware items.

1.5 QUALITY ASSURANCE

A. Qualifications:
    1. Installer Qualifications:
        a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
        b. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
    2. Manufacturer/Supplier Qualifications:
        a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
    3. Testing Agency Qualifications:
        a. Testing Agency shall be approved and recognized by enforcing agency and provide inspection of materials and workmanship during fabrication and assembly.
B. In accordance with Specification Section - REGULATORY REQUIREMENTS
C. Meetings:
    1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
        a. Coordinate the work with other work being performed.
        b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
    2. Progress: Scheduled by the Contractor during the performance of the work.
        a. Review for proper installation of work progress.
        b. Identify any installation problems and acceptable corrective measures.
        c. Identify any measures to maintain or regain project schedule if necessary.
    3. Completion: Scheduled by the Contractor upon proper completion of the work.
        a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
        b. Maintaining installed work until the Notice of Substantial Completion has been executed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
    1. Products shall be individually wrapped.
    2. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage. Damaged products will not be accepted at final inspection.
B. Acceptance at Site:

1. Products must be in manufacturer's original unopened containers with labels (including any fire labels) indicating brand name, model, and grade.

C. Storage and protection:
1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.7 PROJECT CONDITIONS

A. Environmental requirements:
1. Temperature: Maintain ambient temperature in space to receive products in accordance with the latest edition of WDMA I. S. 1-A. Inform the Owner of ambient temperature requirements for products installed and maintain until Substantial Completion and turn-over of the building or facility to the Owner.
2. Humidity: Maintain humidity in space to receive products in accordance with the latest edition of WDMA I. S. 1-A.. Inform the Owner of humidity requirements for products installed and maintain until Substantial Completion and turn-over of the building or facility to the Owner.

B. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

1.8 WARRANTY

A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
1. Materials Warranty:
a. In accordance with manufacturer's written standard warranty.
b. Warranty Period: Life of Installation.
1) Doors shall be warranted for life of installation against warp or twist in excess of 1/4" in any face including full diagonal.
2) Replacement shall include finishing of new replacement door, hardware damaged by malfunction of original door, and hanging in satisfactory operating condition.

C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES:
a. Warranty period Five (5) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified Plastic Laminate- Faced Wood Door product manufacturer:
   a. VT INDUSTRIES.
   b. Acceptable alternative manufacturers:
      1) DOORMERICA
      2) MARSHFIELD DOOR SYSTEMS.
2. Specified High Pressure Decorative Laminate product manufacturer:
   a. WILSONART
   b. Acceptable alternative manufacturers:
      1) ABET LAMINATI.
      2) FORMICA

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 PLASTIC-LAMINATE-FACED DOORS

A. Interior Solid-Core Doors:
1. Grade: WDMA I.S. 1-A "Premium."
2. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade VGS.
3. Colors, Patterns, and Finishes: Refer to Interior Color Schedule
4. Exposed Vertical Edges: Plastic laminate that matches faces applied before faces.
5. Core:
   a. Non-Rated Solid Core Doors:
      1) PC-HPDL-5, particle board core (ANSI A208.1, grade 1-LD-2), hot press bonded under pressure to stiles and rails.
      2) SCLC-HPDL-5, structural composite lumber core, hot press bonded under high pressure to stiles and rails
   b. Fire-Rated Solid Core Doors:
      1) SCLC-20PP-HPDL-5 (20 minute) fire rated, S-Label.
      2) FD-60PP-HPDL-5 (1 hour), FD-90PP-HPDL-5 (1-1/2 hour) fire rated, S-label.

B. Shop Assembly:
1. All doors marked for opening numbers shown on the drawings and with protective wrapping.
   a. Doors shall be Type I adhesive doors regardless of exposure.

C. Hardware:
1. Hardware shall be furnished under Specification Section –HARDWARE.
   a. Coordinate the hardware templates for field fitting and installation into the doors.
2. Doors shall be pre-fit and machined in the factory for mortised hardware, including pilot holes for hinges, according to templates and WDMA.

2.3 ACCESSORIES

A. Astragals at Fire-Rated Double Doors: Manufacturer's standard, UL or WHI tested, located on active leaf as required to meet fire rating and in compliance with CBC.

B. Door Glass and glazing materials.

1. Door Glass: Type as required by code. Conform to provisions of Section 08800.
2. Rated and Non-Rated Metal Vision Frames: AIR LOUVERS, INC., Low Profile Beveled Vision Lite, Web Site http://www.AirLouvers.com , specified for type and quality.
3. Fire Rated Doors: FGS4500 intumescent tape under glass retainer. Positive pressure tested to UL10C.

2.4 FABRICATION

A. Fabricate in accordance with ANSI/WDMA I.S.1-A.

B. Structural composite Stiles, Rails, and Hardware Blocking: Securely bond to core and face veneers with Type I glue. Before applying face veneer, abrasively plane glued unit smooth, both sides.

C. Finish door top and bottom edges, mortises, and edges of cutouts.

D. Hardware Blocking: Provide following ANSI/WDMA I.S. 1-A, Blocking (Reinforcement) options:

1. Structural Composite Core Doors: Not required.
2. Particle Board Core Doors:
   a. 6-inch top rail HB-1.
   b. 5 inch by 18 inch hardware blocking HB-4 at mortise lock side.
   c. Other as required for hardware installation.
3. Incombustible Mineral Core Doors (flame resistant reinforcement)
   a. 6-inch top rail HB-1, 5 inch middle, and bottom rails HB-2, and HB 6.
   b. 5 inch by 18 inch hardware blocking HB-4 at both stiles.
   c. Other as required for hardware installation.

E. Fabricate fire-rated doors in accordance with UL10C, for positive pressure compliance. Attach permanent metal fire-rating label to door edge, either on hinge stile or at top edge where continuous hinges are required.

F. Intumescent Firestop at Stiles and Head: Furnish flush with door edge type intumescent seals per Category A guidelines as published by ITS / Warnock Hersey, exposed at top rail, concealed and laminate covered at stiles. Exposed door and door frame mounted intumescent tape not accepted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:

1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
2. Examine opening and hardware schedules to verify proper coordination.

B. Protection:
1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

C. Surface preparation:
1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

3.3 INSTALLATION

A. General:
1. In accordance with DHI A115.1G, manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved shop drawings.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.

B. Layout:
1. Lines shall be straight and true.

C. Non-Rated Doors:
1. Clearance at jambs and heads: 1/8-inch.
2. Per leaf clearance at meeting stiles for pairs of doors: 1/8-inch.
3. Clearance from bottom of door to top of decorative floor finish or covering: 1/8-inch.
4. Where threshold is shown or scheduled, provide ¼-inch clearance from bottom of door to top of threshold.

D. Fire-Rated Doors:
1. Comply with NFPA 80 for fitting clearances for fire-rated doors.
   a. Threshold Clearances: Consistent Undercut.
      1) Door in fire-rated openings shall not be undercut more than is allowed by CCR T-24, Part 12, Chapter 12-7-4, "Fire Door Assembly Tests."
   b. Conform to the requirements, for assemblies and fire tested in accordance with CCR T-24, Part 12, Chapter 12-7-4, "Fire Door Assembly Tests," and UL10C for positive pressure testing.
      1) 20 minute rated assemblies shall be provided with approved smoke seal gasketing material so installed as to provide a seal where the door meets the stop on both sides and across the top.
      2) Rated doors are to be positive latching and self-closing.

E. Install door hardware in strict accordance with the manufacturers written recommendations, eliminating hinge-bound conditions and making all items smoothly operating and firmly anchored into position.

3.4 REPAIR / RESTORATION

A. Defective Work:
1. Replace, rework or otherwise make good as required doors, finish, frames or hardware found broken, damaged, disfigured or defaced.
2. Incomplete, misaligned, or incorrectly located products will not be accepted.

3.5 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
   1. Clean any soiled surfaces immediately.
   2. Finish shall be clean and ready for the application of any additional finishes.
   3. In accordance with manufacturer's written instructions and recommendations.

3.6 PROTECTION

A. Protection from traffic:
   1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

END OF SECTION

SECTION 08 31 13 – ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all materials, labor, equipment and services necessary to furnish and install Equipment Access Doors, accessories and other related items necessary to complete Project as indicated by the Contract Documents unless specifically excluded.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 06 10 00 ROUGH CARPENTRY
   4. 08 11 00 METAL DOORS AND FRAMES
   5. 08 34 73 ACOUSTICAL DOORS AND FRAMES
   6. 09 22 16 METAL FRAMING
   7. 09 24 00 CEMENT PLASTER
   8. 09 29 00 GYPSUM BOARD
   9. 09 30 00 TILE
   10. 09 91 00 PAINTING
   11. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product Data.
      a. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
      b. Submit manufacturer's standard color range for selection by the Architect.
   2. Shop Drawings.
      a. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loading, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Closeout Submittals in accordance with Specification Sections in Division One:
      a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
      b. Operation Data in accordance with Specification Section - PROJECT CLOSEOUT.
      c. Project Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.
      d. Warranty in accordance with Specification Section - WARRANTIES.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
      b. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
   2. Manufacturer/Supplier Qualifications:

a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. In accordance with Specification Section - REGULATORY REQUIREMENTS.

C. Meetings:

1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
   a. Coordinate the work with other work being performed.
   b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
   a. Review for proper installation of work progress.
   b. Identify any installation problems and acceptable corrective measures.
   c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
   a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
   b. Maintaining installed work until the Notice of Substantial Completion has been executed.

1.4 WARRANTY

A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:

1. In accordance with manufacturer's written standard warranty:
   a. Warranty Period One (1) Year.

C. Installer's Warranty:

1. In accordance with the terms of the Specification Section - WARRANTIES:
   a. Warranty period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified product manufacturer:
   a. MILCOR INCORPORATED, INC.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Access Doors:

1. Design: Equal to Style AP, DW, AT, K or M Access Door as manufactured by MILCOR INCORPORATED, Lima, Ohio.
   a. Design shall match material conditions present in each specific location.

b. In Cement Plaster locations, provide not less than 16 gage frames with a minimum of 24 gage expanded or perforated metal wings designed to finish flush with plaster.

2. Size: Refer to Architectural, Plumbing, Mechanical, and Electrical Drawings.
3. Material: Steel Frame and Door.
4. Operation: Manual
5. Lock: Key operated cylinder lock
6. Finish: Shop Primed, unless otherwise noted.
   a. In Shower, Toilet, or Locker Rooms all exposed portions shall be brushed stainless steel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
   2. Coordinate access doors with related items specified under other Sections to ensure proper and adequate interface of work. Particular attention is called to all Plumbing, Mechanical, and Electrical Specifications and drawings and the full cooperation required with that subcontractor's needs and work.

3.2 INSTALLATION

A. General:
   1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
   2. In accordance with approved submittals.
   3. In accordance with Regulatory Requirements.
   4. Set plumb, level, and square.

END OF SECTION

SECTION 08 33 00 – COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all Coiling Doors, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
    a. Superimposed coiling door consisting of an insulated door and perforated door.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 30 00 CAST-IN-PLACE CONCRETE
4. 04 22 00 CONCRETE MASONRY UNITS
5. 05 12 00 STEEL AND FABRICATIONS
6. 06 10 00 ROUGH CARPENTRY
7. 07 40 00 METAL PANELS
8. 08 11 00 METAL DOORS AND FRAMES
9. 08 34 73 ACOUSTICAL DOORS AND FRAMES
10. 08 70 00 HARDWARE
11. 09 22 16 METAL FRAMING
12. 09 24 00 CEMENT PLASTER
13. 09 26 13 VENEER PLASTER
14. 09 29 00 GYPSUM BOARD
15. 09 91 00 PAINTING
16. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:

1. In accordance with the following standards:
    a. FMG Factory Mutual Global.
    b. ITS Intertek Testing Services.
    c. NEMA National Electrical Manufacturers Association.
    d. NFPA National Fire Protection Association.
        1) Provide assemblies, when applicable, complying with NFPA 80 that are identical to door and frame assemblies tested for fire-response characteristics per UL 10b and NFPA 252, and that are listed and labeled for fire-ratings indicated by UL, FMG, ITS, or another testing and inspection agency acceptable to DSA/FLS.
        2) Provide certification by a testing agency acceptable to DSA/FLS that oversized fire-rated door assemblies, when applicable, comply with all standard construction requirements of tested and labeled fire-rated doors assemblies except for size.
        3) Provide electrical components, devices and accessories, when applicable, that are listed and labeled as defined in NFPA 70, Article 100.
    e. UL Underwriters Laboratories Inc.

1.3 DEFINITIONS

A. The following definitions apply to the products of this Specification Section:

1. Astragal: Weatherstripping attached to the Bottom Bar.
2. Barrel: The assembly containing the counterbalancing springs of the unit.
3. Between Jamb Mounted: Unit installed between the jambs of the opening.
4. Bottom Bar: Bottom element of a coiling door or grille that rests on the sill or floor.
5. Bracket: Plates at each end of the door that are bolted to the guides to support the barrel and curtain assembly.
6. Curtain: The main body of the door that can be made up of slats, rods or links.
7. End Locks: Metal pieces attached to the ends of the slats to prevent lateral shifting.
8. Face Of Wall Mounted: Unit installed at the face of the jamb either inside or outside the structure.
9. Guide: The side track of the door.
10. Guide Weatherstrip: Vinyl or Neoprene material secured to the inside angle of the guide to prevent air infiltration.
11. Hood: The sheet metal cover attached to the brackets to enclose the barrel assembly.
12. Hood Baffle: A piece of waterproof canvas attached to the interior of the hood to prevent air infiltration.
13. Inside Angle: Interior angle forming the channel in which the door goes up and down.
14. Insulated Door: Door constructed with a double-slated curtain filled with insulation.
15. Service Door: Large, slatted doors used to close large openings in industrial and commercial applications.
16. Slat: Interlocking metal shapes that comprise the curtain of the door.
17. Stop: Metal pieces attached to the guide to prevent the bottom bar from going up into the hood.
18. Torsion Springs: Springs wound clockwise or counter clockwise position to counterbalance weight.
19. Wall Angle: The angle of the door guide attached to the wall that supports the bracket.
20. Windlocks: Metal pieces attached to the ends of the slats that interlock with the windlock bar in the guide to prevent the curtain from blowing out of the guides.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Product Data.
    a. Submit manufacturer's standard color range for selection by the Architect.
    b. Submit manufacturer's full color range (including any standard, premium and custom colors) for selection by the Architect.
    c. Include description of fire-release system including testing and resetting instructions.
2. Shop Drawings.
    a. Submit shop drawings prepared by, or under the supervision of a registered Civil or Structural Engineer in the State of California, detailing fabrication and assembly-- as well as procedures and diagrams-- of the work under this section. Include setting drawings, templates, and directions for installation of anchor bolts and other anchorage to be installed as unit of work of other related sections.
    b. Submit shop drawings showing fabrication and installation of the work of this section including plans, elevations, sections, details of components, and attachments to other units of work.
        1) Where installed products are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis that has been signed and stamped by a registered Civil or Structural Engineer in the State of California.

c. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loading, required clearances, method of field assembly, components, and location and size of each field connection.

3. Quality Assurance/Control Submittals:
   a. Manufacturer's Written Instructions.
   b. Manufacturer's Field Reports.
   c. Engineering Calculations.
      1) Submit engineering calculations computed and signed by a registered Civil or Structural Engineer in the State of California.
4. Closeout Submittals in accordance with the following:
   a. Maintenance Data per Specification Section - PROJECT CLOSEOUT.
   b. Operation Data per Specification Section - PROJECT CLOSEOUT.
   c. Warranty per Specification Section - WARRANTIES.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications:
      a. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
   2. Manufacturer/Supplier Qualifications:
      a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. In accordance with Specification Section - REGULATORY REQUIREMENTS.

1.6 OWNER'S INSTRUCTIONS

A. Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train the Owner's maintenance personnel as specified below:
   1. Test and adjust controls and any safeties. Replace damaged or malfunctioning controls and equipment.

1.7 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written standard warranty:
      a. Warranty Period One (1) Year.

C. Installer's Warranty:
   1. In accordance with the terms of the Specification Section - WARRANTIES:
      a. Warranty period Five (5) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified Overhead Coiling Door and Grille products manufacturer, or approved equivalent:
   a. CORNELL/COOKSON COMPANY.
   b. Acceptable alternative manufacturers:
      1) OVERHEAD DOOR CORPORATION.
      2) WAYNE DALTON.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MANUFACTURED UNITS

A. Overhead Coiling Service Doors:

1. Door Curtain Materials and Construction:
   a. Verify the size of this overhead door with the operation.
   b. Door Curtains: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
      1) Steel Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel (SS) sheet; complying with ASTM A 653 "Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron, Alloy-Coated (Galvanealed) by the Hot-Dip Process," G90 (Z275) coating designation.
         a) Minimum Specified Thickness: Not less than 22 Gage (0.0299").
         b) Flat profile slats.
   c. Curtain Insulation: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials." Provide an "R" Value of at least 6.29. Enclose insulation completely within metal slat faces.
      1) Inside Curtain Slat Face: To match material of outside metal curtain slat.
2. Endlocks:
   a. Service Door Endlocks and Windlocks: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
   b. Counter Shutter Endlocks: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
3. Bottom Bars:
   a. Service Door: Consisting of 2 angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; galvanized, stainless-steel, or aluminum extrusions to suit type of curtain slats.

1) Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene; for placement between angles or fitted to shape, as a cushion bumper for interior door.

b. Counter Shutters: Manufacturer's standard continuous channel or tubular shape, either stainless-steel or aluminum extrusions to suit type of curtain slats.

1) Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene; for placement between angles or fitted to shape, as a cushion bumper for interior door.

4. Curtain Jamb Guides:

a. Service Door: Fabricate curtain jamb guides of steel angles or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than 3/16-inch thick galvanized steel sections complying with ASTM A 36 "Specification for Carbon Structural Steel" and ASTM A 123 "Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products." Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

b. Counter Shutter: Fabricate curtain jamb guides of angles or channels and angles of material and finish to match curtain slats, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.

5. Seals:

a. Smoke Seals: Provide UL-listed and -tested smoke-seal perimeter gaskets when applicable.

b. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and top of all doors (to minimize sound of operation regardless of weatherstripping requirements). At door head, use 1/8-inch thick, replaceable, continuous sheet secured to inside of hood.

1) Provide motor-operated doors with combination bottom weatherseal and sensor edge.

2) In addition, provide replaceable, adjustable, continuous, flexible, 1/8-inch thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weathertight installation.

B. Coiling Grilles

1. Grille Curtain Materials and Construction:

a. General: Fabricate overhead coiling grille curtain consisting of a network of 5/16-inch minimum diameter horizontal rods, or rods covered with tube spacers, spaced as indicated. Interconnect rods by vertical links approximately 5/8 inch wide, spaced as indicated and rotating on rods.

b. Space rods at approximately 1-1/2 inches o.c.

1) Space links approximately 9 inches apart in a straight in-line pattern.

c. Stainless-Steel Grille Curtain: ASTM A 666 "Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar," Type 300 series.

2. Endlocks:

a. Continuous end links, chains, or other devices at ends of rods; locking and retaining grille curtain in guides against excessive pressures, maintaining grille curtain alignment, and preventing lateral movement.

3. Bottom Bar:

a. Manufacturer's standard continuous channel, tubular shape, or two angles, finished to match grille.

b. Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene; for placement between angles or fitted to shape, as a cushion bumper for grille.
c. Provide motor-operated grilles with combination bottom astragal and sensor edge.

4. Grille Curtain Jamb Guides:
   a. Manufacturer's standard extruded-aluminum shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.
   b. Removable Posts and Jamb Guides: Manufacturer's standard.

C. Hoods:
1. Form round hoods to act as weatherseal and entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods, and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.
   a. Fabricate hoods for steel doors of minimum 0.028-inch thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653 "Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron, Alloy-Coated (Galvanealed) by the Hot-Dip Process."
   b. Fabricate hoods for stainless-steel doors of minimum 0.025-inch thick stainless-steel sheet, Type 304, complying with ASTM A 666 "Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar."
   c. For fire-rated assemblies, include automatic drop baffle to guard against passage of smoke or flame. Fabricate hoods for stainless-steel grilles of minimum 0.025-inch-(0.65-mm-) thick stainless-steel sheet, Type 300 series, complying with ASTM A 666 "Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar."
2. Counter Shutter Integral Frame, Hood, and Fascia: Provide welded assemblies of the following sheet metal:
   a. Fabricate from minimum 0.0625-inch thick stainless-steel sheet, Type 304, complying with ASTM A 240 "Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications" or ASTM A 666 "Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar."

D. Counterbalancing mechanism:
1. General: Counterbalance curtain by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
2. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of curtain and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
3. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.
4. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
5. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate, galvanized.

E. Operators:

1. Chain-Hoist: Provide manual chain-hoist operator consisting of endless steel hand chain, chain pocket wheel and guard, and gear-reduction unit with a maximum 35-lbf (155-N) force for door operation. Provide alloy steel hand chain with chain holder secured to operator guide. Provide through-wall shaft operator.
2. Electric Motor:
    a. Provide electric door operator assembly of size and capacity recommended andprovided by door manufacturer for door specified complying with NFPA 70, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
    b. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
    c. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.
    d. Door-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft-type door operator unit consisting of electric motor drive, and chain and sprocket secondary drive.
    e. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or service factor.
        1) Service Factor: According to NEMA MG 1, unless otherwise indicated.
        2) Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
        3) Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
    f. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2-control circuit, maximum 24-V, ac or dc.
    g. Remote-Control Station: Provide momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
    h. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
    i. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
        1) Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel.
        2) Connect to control circuit using manufacturers wireless technology.
        3) Provide electrically actuated automatic bottom bar.
    j. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
    k. Provide safety interlock switch to disengage power supply when curtain is locked.

F. Hardware:
1. Locking Devices: Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.
    a. Locking Bars, full-disc cremone type, both sides, operable from inside only.
    b. Power-operated doors: If door unit is power-operated, provide safety interlock switch to disengage power supply when door is locked.

2. Push/Pull Handles: For push-up-operated or emergency-operated curtains, provide manufacturer's standard lifting handles on each side of curtains. Maximum effort shall not exceed 30 pounds to pull/push up or down.
   a. Provide pull-down straps or pole hooks for curtains more than 84 inches (2130 mm) high.
3. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from coil side.

2.3 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel and Galvanized Steel Finishes:
1. Zinc-Coated (Galvanized) Steel: ASTM A 653 "Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron, Alloy-Coated (Galvanealed) by the Hot-Dip Process," G90 coating designation; structural quality.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:
1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

C. Surface preparation:
1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

3.3 INSTALLATION

A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.

2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.

B. Layout:
1. Lines shall be straight and true.

3.4 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion and with weathertight fit around entire perimeter.

B. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

3.5 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
1. Clean any soiled surfaces immediately.
2. Finish shall be clean and ready for the application of any additional finishes.
3. In accordance with manufacturer's written instructions and recommendations.

3.6 DEMONSTRATION

A. In accordance with Specification Section - PROJECT CLOSEOUT.
1. Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train Owner's maintenance personnel as specified below.
a. Schedule training with the Owner's maintenance personnel with at least seven (7) days advance notice.
b. Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance.
c. Review data in "Operating and Maintenance Manuals." Refer to Specification Section - PROJECT CLOSEOUT.

3.7 SCHEDULES

A. Type: **CD**
1. Motor Operated Superimposed Coiling Door
2. Mounting: Face of Wall.
3. Auxiliary chain operation.
4. Coiling Door, Insulated Curtain.
a. Operation: Motor. 120V, 1PH, 60 HZ, 3.4 FLA.
b. Slat Type: 22/22 ga. Insulated.
c. Curtain Finish: Galvanized Steel.
5. Coiling Door, Perforated Curtain.
a. Operation: Motor. 120V, 1PH, 60 HZ, 4.5 FLA.
b. Slat Type: 20 ga. Perforated.
c. Curtain Finish: Galvanized Steel.

END OF SECTION

SECTION 08 41 00 – STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 03 30 00 CAST-IN-PLACE CONCRETE
   4. 04 22 00 CONCRETE MASONRY UNITS
   5. 05 12 00 STEEL AND FABRICATIONS
   6. 06 10 00 ROUGH CARPENTRY
   7. 07 60 00 SHEET METAL
   8. 07 92 00 SEALANTS
   9. 08 11 00 METAL DOORS AND FRAMES
   10. 08 14 16 WOOD DOORS
   11. 08 70 00 HARDWARE
   12. 08 80 00 GLASS
   13. 09 22 16 METAL FRAMING
   14. 09 24 00 CEMENT PLASTER
   15. 09 29 00 GYPSUM BOARD
   16. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
      a. Coordinate Storefront System to receive internal cabling for Facility Service Systems, including but not limited to:
         1) Electrical System.
         2) Intrusion Detection System.
         3) Access Control System.

1.2 REFERENCES

A. Standards:
   1. In accordance with the following standards:
      a. AA Aluminum Association
      b. AAMA American Architectural Manufacturers Association
      c. ADA Americans with Disabilities Act
      d. ADAAG Americans with Disabilities Act Accessibility Guidelines – "For Buildings and Facilities".
      e. ANSI American National Standards Institute
      f. ASCE American Society of Civil Engineers
      g. AWS American Welding Society
      h. BHMA Builders Hardware Manufacturers Association
      i. GANA Glass Association of North America
      j. NAAMM National Association of Architectural Metal Manufacturers
      k. NFRC National Fenestration Rating Council
      l. SSPC The Society for Protective Coatings (formerly the Steel Structures Painting Council)

1.3 DEFINITIONS

A. Exterior and Interior Storefront Systems – indicated on the drawings as SF.

B. Exterior Window Wall / Curtain Wall Systems – indicated on the drawings as CW.

1.4 SYSTEM DESCRIPTION

A. General: Provide aluminum systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes the following:

1. Air infiltration and water penetration exceeding specified limits.
2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

B. Design Requirements: In accordance with allowable values and properties assigned and approved by CBC.

1. Wind Loads: Provide aluminum systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineer's ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Design Procedure," whichever are more stringent.
   a. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or 3/4 inch, whichever is smaller, unless otherwise indicated.
   b. Static-Pressure Test Performance: Provide entrance and storefront systems that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330 "Test Method for Structural performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference."
      1) Wind Load: See Drawings.
         a) Comply with CBC Section 1609A.
      2) Test Pressure: 150 percent of inward and outward wind-load design pressures.
      3) Duration: As required by design wind velocity; fastest 1 mile of wind for relevant exposure category.

C. Seismic Loads: Provide aluminum systems, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of authorities having jurisdiction or ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Chapter 13, Section 13.5.9 "Glass in Glazed Walls, Glazed Storefronts, and Glazed Partitions," whichever are more stringent.

1. Dead Loads: Provide aluminum system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.
   a. Provide a minimum 1/8-inch clearance between members and top of glazing or other fixed part immediately below.
   b. Provide a minimum 1/16-inch clearance between members and operable windows and doors.
2. Live Loads: Provide aluminum systems, including anchorage, that accommodate the supporting structure's deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.
3. Air Infiltration: Provide aluminum systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 "Test method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen," at a static-air-pressure difference of 1.57 lbf/sq. ft.

4. Water Penetration: Provide aluminum systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 "Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Aire Pressure Difference," at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft.. Water leakage is defined as follows:
    a. Uncontrolled water infiltrating systems or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
5. Thermal Movements: Provide aluminum systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.
    a. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
6. Structural-Support Movement: Provide aluminum systems that accommodate structural movements including, but not limited to, sway and deflection.
7. Condensation Resistance: Provide aluminum systems with condensation resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.1.
8. Average Thermal Conductance: Provide aluminum systems with average U-values of not more than 0.63 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.1.
9. Dimensional Tolerances: Provide aluminum systems that accommodate dimensional tolerances of building frame and other adjacent construction.
10. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code – Aluminum."

1.5 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

B. Product Data.
    1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
    2. Submit manufacturer's standard color range for selection by the Architect.

C. Shop Drawings.
    1. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loading, required clearances, method of field assembly, components, and location and size of each field connection.
        a. For entrance systems, include hardware schedule and indicate operating hardware types, quantities, and locations.
        b. Where storefront installed products are indicated to comply with certain design loading, include structural computations, material properties, and other information needed for structural analysis that has been signed and stamped by a registered Civil or Structural Engineer in the State of California.

D. Samples.
    1. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
    2. Cutaway Sample: Of each vertical-to-horizontal framing intersection of systems, made from minimum 6-inch lengths of full-size components and showing details of the following:
        a. Joinery.

b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

E. Quality Assurance/Control Submittals:
1. Test Reports:
a. Sealant Compatibility and Adhesion Test Reports:
1) From sealant manufacturer, indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with sealants; include joint sealant manufacturers' written interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.
b. Field Test Reports:
1) Indicate and interpret test results for compliance with storefront system's performance requirements.
2) Submit Engineered Transition Assembly Tests from manufacturer.
3) Submit results of the Water Spray Test.
c. Product Test Reports:
1) Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of entrance and storefront systems with requirements based on comprehensive testing of current systems.
2. Certificates:
a. Submit three copies of certificates.
b. NFRC Certificates for each frame type by each glass type.
3. Manufacturer's Written Instructions:
a. Submit three copies of manufacturer's written instructions.
4. Manufacturer's Field Reports:
a. Submit three copies of manufacturer's field reports.

F. Closeout Submittals in accordance with the following:
a. Maintenance Data per Specification Section - PROJECT CLOSEOUT.
b. Operation Data per Specification Section - PROJECT CLOSEOUT.
c. Project Record Documents per Specification Section - PROJECT DOCUMENTS.
d. Warranty per Specification Section - WARRANTIES.

1.6 QUALITY ASSURANCE

A. Qualifications:
1. Material Qualifications:
a. Obtain each type of aluminum system through one source from a single manufacturer.
b. Do not modify intended aesthetic effect, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirement. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.
2. Installer Qualifications:
a. Engage an experienced installer to assume engineering responsibility and perform work of this section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable of manufacturer.
1) Engineering Responsibility: Prepare data for aluminum systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

b. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
c. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.

3. Testing Agency Qualifications:
a. Demonstrate to Architect's satisfaction, based on Architect's evaluation of criteria conforming to ASTM E 699 "Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components," that the independent testing agency has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
a. ADA Americans with Disabilities Act
b. ADAAG Americans with Disabilities Act Accessibility Guidelines

C. Mockups: Before installing aluminum systems, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.
1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before proceeding with installation of systems.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
a. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 WARRANTY

A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
1. In accordance with manufacturer's written standard warranty:
2. Submit a written warranty executed by the manufacturer agreeing to repair or replace components of entrance and storefront systems that fail in materials or workmanship within the specified warranty period.
a. Warranty Period: 2 years from date of Substantial Completion.
b. Failures include, but are not limited to, the following:
1) Structural failures including, but not limited to, excessive deflection.
2) Adhesive sealant failures.
3) Cohesive sealant failures.
4) Failure of system to meet performance requirements.
5) Deterioration of metals, metal finishes, and other materials, beyond normal weathering.
6) Failure of operating components to function normally.

7) Water leakage through fixed glazing and frame areas.

3. Manufacturer's Special Warranty on Door Components: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of door systems that fail at the Door Corners within the specified warranty period.
   a. Warranty Period: Lifetime on Door Corners.

C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES.
2. Workmanship Warranty:
   a. Warranty Period: Five (5) years.
   b. Upon project completion and acceptance, the subcontractor shall issue Owner a warranty against defective workmanship and materials.
   c. The subcontractor shall warranty to maintain the entrance and storefront system conditions for the period of years specified from the date of acceptance and shall be responsible for the repair of any failure that is the result of defects in materials and workmanship.
   d. The subcontractor shall obtain from the manufacturer and the General Contractor a co-endorsement of the Warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project, or approved equivalent. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
1. Specified product manufacturer:
   a. KAWNEER COMPANY, INC., utilizing the following products:
      1) SF – Storefront System, Exterior: TRI-FAB VG 451T.
      2) SF – Storefront System, Interior: TRI-FAB VG 451.
      3) CW – Window Wall System 1600 WALL.
      4) Entrance Doors 500 TUFFLINE.
   b. Acceptable alternative manufacturers:
      1) OLDCASTLE GLASS, allowing the following equivalents to the KAWNEER products listed above:
         a) SF – Storefront System, Exterior: FG-3000 Thermal Multi-Pane.
         b) SF – Storefront System, Interior: FG-3000.
         c) CW – Window Wall System CW-250.
         d) Entrance Doors RuggedLineWS.
2. Specified Engineered Transition Assembly manufacturer:
   a. TREMCO “Pro Glaze ETA” series.
3. Specified Partition Gap Closure Assembly manufacturer:
   a. GORDON, INC. “Mullion Mate” Series 40.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.

1. Sheet and Plate: ASTM B 209 “Specification for Aluminum and Aluminum-Alloy Sheet and Plate.”
2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221 "Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.”
3. Extruded Structural Pipe and Tubes: ASTM B 429 “Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.”
4. Bars, Rods, and Wire: ASTM B 211 “Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.”
5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement: Complying with ASTM A 36 "Specification for Carbon Structural Steel," for structural shapes, plates, and bars; ASTM A 1008 "Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable," for cold-rolled sheet and strip; or ASTM A 1011 "Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength," for hot-rolled sheet and strip.

C. Glazing as specified in Specification Section - GLASS.
1. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended in writing by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended in writing by gasket manufacturer.
2. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended in writing by manufacturer, compatible with sealants, and suitable for system performance requirements.

D. Sealant and Joint Fillers for joints at perimeter of aluminum systems as specified in Specification Section – SEALANTS.
1. Sealant: For use as weatherseal, compatible with other system components with which it comes in contact, and that accommodates a 50 percent increase or decrease in joint width at the time of application when measured according to ASTM C 719 "Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)."
   a. Framing system gaskets, sealants, and joint fillers as recommended in writing by manufacturer for joint type.

E. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil thickness per coat.

2.3 ACCESSORIES

A. Hardware:
1. General: Provide heavy-duty hardware units indicated in sizes, number, and type recommended in writing by manufacturer for entrances indicated. Finish exposed parts to match door finish, unless otherwise indicated.
   a. Continuous Gear Hinges: Manufacturer's standard, continuous, aluminum gear hinges.
   b. Closers, General: Comply with manufacturer's written recommendations for closer size, depending on door size, exposure to weather, and anticipated frequency of use.
      1) Closing Cycle: Comply with requirements of authorities having jurisdiction or the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," whichever are more stringent.
      2) Opening Force: Comply with the following maximum opening-force requirements for locations indicated:
         a) Exterior Doors: 5 lbf.
         b) Interior Doors: 5 lbf.

c. Surface-Mounted Overhead Closers: ANSI/BHMA A156.4, Grade 1. Provide cover and the following:
   1) Mounting: Parallel Arm.
   2) Back Check Adjustable.
d. Door Stops: ANSI/BHMA A156.16, Grade 1, floor- or wall-mounted door stop, as appropriate for door location indicated, with integral rubber bumper.
e. Cylinders: As specified in Specification Section – HARDWARE.
f. Rim Cylinders: Manufacturer's standard rim cylinders for installation in exit devices complying with ANSI/BHMA A156.5, Grade 1 requirements.
g. Rim-Mounted Exit Devices: Rim-type exit device complying with UL 305 requirements and with one-point latching at door-lock stile that is released by a full-width crash bar or when locked down (dogged) by lock cylinder or retracting screws beneath housing.
h. Removable Mullions: See Specification Section – HARDWARE.
i. Pull Handles: As selected by Architect from manufacturer's full range of tubular pull handles and plates.
j. Thresholds: At exterior doors, provide manufacturer's standard threshold with cutouts coordinated for operating hardware, with anchors and jamb clips, and not more than 1/2-inch high, with beveled edges providing a floor level change with a slope of not more than 1:2, and in the following material:
   1) Material: Aluminum, mill finish.
k. Weather Sweeps: Manufacturer's standard weather sweep for application to exterior door bottoms and with concealed fasteners on mounting strips

B. Engineered Transition Assembly ("Proglaze ETA"):
1. Performance Requirements:

TEST	TEST METHOD	VALUE
Water Vapor Transmission	ASTM E 96	2.59 Perms
Air Infiltration 75 Pa 300 Pa	ASTM E 283	 Less than 0.05 L/s/m2 Less than 0.05 L/s/m2
Water Resistance	ASTM E 547 / ASTM E 331	No Leakage
Uniform Load Deflection	ASTM E 330	No Damage
Uniform Load Structural	ASTM E 330	No Damage

2. Pre-Engineered, finished aluminum and silicone materials used as a transition assembly. The system assembly is mechanically attached to the window assembly to assure a durable seal is achieved. The engineered transitions assembly is comprised of the following components:
   a. "Silicone Rubber Sheet": Extruded, 40 durometer, translucent silicone, with lock-
   b. in-dart, 6 inch width.
   c. "Silicone Rubber Corners": Pre-molded, 40 durometer, translucent silicone, with lock-in-dart, 6 inch width, offset 1.5" to allow lap joint to be made with the Silicone Rubber Extrusion.
   d. "Extruded Aluminum Adapter": Alodine finished, pre-engineered race for receiving silicone lock-in-dart, supplied in five (5) foot lengths with pre-drilled holes every 6" on center.
   e. Tape: "440 TAPE": Solid polyisobutylene-cross linked butyl preformed sealant.
   f. Silicone Sealant: "Spectrem 1": Single-component, neutral-curing silicone sealant, complying with ASTM C 920 "Specification for Elastomeric Joint Sealants."

C. Partition Gap Closure Assembly: Provide extruded Aluminum 6063-T5 alloy, pre-assembled and spring-loaded to provide a tight fit for vertical junctures of partitions and window walls. Match storefront system finish.

2.4 COMPONENTS

A. Aluminum Framing: Provide manufacturer's framing compatible with the Manufacturer's Model Numbers specified within the MANUFACTURER's article above. All components shall comply with the Aluminum standards listed under the MATERIALS article above, and wall thicknesses and finish shall comply with Manufacturer's Model Numbers and FINISHES article within this specification section.
   1. Construction: Thermally broken at exterior locations. Non-thermally broken at interior locations.

B. Aluminum Doors:
   1. Standard Doors: Provide manufacturer's standard 1-3/4 inch thick glazed doors with minimum 0.1875 inch thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.
      a. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.
      b. Stile Design: Wide Stile, 5 inch nominal width.
   2. Heavy Doors: Provide manufacturer's Heavy-Duty Entrance Doors that are 2 inch thick glazed doors with minimum 3/16 inch thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.
      a. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.
      b. Stile Design: Wide Stile, 5 inch nominal width.

C. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide non-staining, nonferrous shims for aligning system components.

D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding, flashing, compatible with adjacent materials, and of type recommended in writing by manufacturer.

E. Weatherstripping: Manufacturer's standard replaceable weatherstripping as follows:
   1. Compression Weatherstripping: Molded neoprene complying with ASTM D 2000 "Classification System for Rubber Products in Automotive Applications" requirements or molded PVC complying with ASTM D 2287 "Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds" requirements.

2.5 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
   1. Fabricate storefront system components for screw-spline frame construction.
   2. Fabricate window wall system and entrance door components for shear-block frame construction.
   3. Fabricate components for head- and sill-receptor frame construction with shear-block construction at intermediate horizontal components.

B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

C. Prepare components to receive concealed fasteners and anchor and connection devices.

D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

F. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to GANA's "Glazing Manual."

G. Glazing Channels: Provide minimum clearances for thickness and type of plastic sheet indicated according to plastic sheet manufacturer's written instructions.

H. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

I. Storefront: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.

J. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.

1. Exterior Doors: Provide compression weather stripping at fixed stops.
2. Interior Doors: Provide ANSI/BHMA A156.16 silencers at stops to prevent metal to metal contact. Provide 3 silencers on strike jamb of single-door frames and 2 silencers on head of double-door frames.

2.6 FINISHES

A. Aluminum:

1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
2. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
3. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
4. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker. Refer to Interior Color Schedule for location(s)
5. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
   a. Color: **Black**. Refer to Interior Color Schedule for location(s)

B. Steel Priming:

1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer.
2. Surface Preparation: Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.
3. Priming: Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

2.7 SOURCE QUALITY CONTROL

A. Tests, Inspection:

1. Pre-Construction Sealant Testing: Perform sealant manufacturer's standard tests for compatibility and adhesion of sealants with each material that will come in contact with sealants and each condition required by system.
   a. Test a minimum of 8 samples of each metal, glazing, and other material.

b. Prepare samples using techniques and primers required for installed systems.
c. Perform tests under environmental conditions that duplicate those under which systems will be installed.
d. For materials that fail tests, determine corrective measures required to prepare each material to ensure compatibility with and adhesion of sealants, including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:
1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
2. Metal Protection:
a. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
b. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Surface preparation:
1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) that could impair bond of materials specified within this section.

3.3 INSTALLATION

A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
a. Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.
5. Do not install damaged components.
6. Fit frame joints to produce hairline joints free of burrs and distortion.

7. Rigidly secure non-movement joints.
8. All vertical storefront mullions are continuous; horizontal mullions shall frame into the vertical mullions.
9. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
10. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated.
11. Seal joints weathertight.

B. Layout:
1. Lines shall be straight and true.
a. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.
b. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.
1) Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.
c. Install glazing as follows:
1) Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
a) Preparation includes, but is not limited to, cleaning and priming surfaces.
2) Install structural silicone sealant according to sealant manufacturer's written instructions.
3) Mechanically fasten glazing in place until structural sealant is cured.
4) Remove excess sealant from component surfaces before sealant has cured.
5) Install sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints.
a) Install joint fillers behind sealant as recommended in writing by sealant manufacturer.
6) Install perimeter sealant to comply with requirements of Specification Section - SEALANTS unless otherwise indicated.

C. Assistance:
1. Application shall be in direct consultation and review of manufacturer's representative.

3.4 FIELD QUALITY CONTROL

A. Installation Tolerances:
1. Install aluminum systems to comply with the following maximum tolerances:
a. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet; 1/4 inch over total length.
b. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
c. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

B. Site Tests:
1. As required by Regulatory Requirements.
2. Water Spray Test: After completing the installation of test areas indicated (which includes all exterior finishes, glazing, and sealants down to the exterior face of studs, but no cavity insulation or interior finishes), test storefront system for water penetration according to AAMA 501.2 requirements.
a. Provide report of the result of all testing.
3. Repair or remove and replace Work that does not meet requirements or that is damaged by testing; replace to conform to specified requirements.

C. Inspection:
   1. As required by Regulatory Requirements.
   2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
   3. No work shall be without the inspections required by Regulatory Requirements.
   4. Engineered Transition Assembly inspection by a qualified manufacturer's representative of 20 percent of the entire installation shall take place as installation proceeds to determine compliance of installed assemblies with specified acquirements.

3.5 ADJUSTING

A. Adjust doors and hardware to provide tight fit at contact points and weatherstripping, smooth operation, and weathertight closure.

3.6 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
   1. Clean any soiled surfaces immediately.
   2. Finish shall be clean and ready for the application of any additional finishes.
   3. In accordance with manufacturer's written instructions and recommendations.

3.7 PROTECTION

A. Protection from traffic:
   1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.
   2. Immediately after cleaning, neatly apply 4 mil thick, minimum, polyethylene film over finished surfaces at traffic areas. Fasten film firmly to surface.

END OF SECTION

SECTION 08 42 29 - AUTOMATIC ENTRANCE DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all Automatic Entrance Door Operator materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 04 22 00 CONCRETE MASONRY UNITS
   4. 05 12 00 STEEL AND FABRICATIONS
   5. 07 21 00 INSULATION
   6. 07 92 00 SEALANTS
   7. 08 41 00 STOREFRONTS
   8. 08 70 00 HARDWARE
   9. 08 80 00 GLASS
   10. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP

1.2 REFERENCES

A. Standards:
   1. In accordance with the following standards:
      a. AA Aluminum Association
      b. AAMA American Architectural Manufacturers Association
      c. ANSI American National Standards Institute
      d. NFPA National Fire Protection Association
      e. UL Underwriters Laboratory, Inc.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: It is the intention of this section and the drawings to form a guide for a complete and operable system. Any items not specifically noted but necessary for a complete and operable system shall be provided under this section.
   1. Provide automatic aluminum door operators which have been manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.
   2. Electrical:
      a. 120 VAC, 60 cycle, 1 phase, 15 amp. Two low-voltage wires shall be furnished to connect each push button/plate switch to the operator.
      b. Provide battery back-up power source to meet CBC 11B-404.2.9.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section - Submittal Procedures:
   1. Product Data.

a. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
b. Submit manufacturer's standard color range for selection by the Architect.

2. Shop Drawings.
   a. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loading, required clearances, method of field assembly, components, and location and size of each field connection, and revise as required by the Governing Authority or site conditions.
3. Quality Assurance/Control Submittals:
   a. Manufacturer's Instructions:
      1) Submit three (3) copies of manufacturer's instructions.
   b. Manufacturer's Field Reports:
      1) Submit three (3) copies of manufacturer's field reports.
4. Closeout Submittals in accordance with the following:
   a. Maintenance Data in accordance with Specification Section - Project Closeout.
   b. Operation Data in accordance with Specification Section - Project Closeout.
   c. Record Documents in accordance with Specification Section - Record Documents.
   d. Warranty in accordance with Specification Section - Product Warranties.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
      b. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's system in accordance with manufacturer's warranty requirements.
   2. Manufacturer/Supplier Qualifications:
      a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
      a. CBC General Requirements:
         1) All Horizontal Sliding Doors shall comply with CBC 1010.3.3.
         2) The door shall be power operated and shall be capable of being operated manually in the event of a power failure
         3) The doors shall be openable by a simple method from both sides without special knowledge or effort.
         4) The force required to operate the door shall not exceed 30 pounds to set the door in motion, and 15 pounds to close the door or open it to the minimum required width.
         5) The door shall be openable with a force not to exceed 15 pounds when a force of 250 pounds is applied perpendicular to the door adjacent to the operating device.
         6) The door assembly shall comply with the applicable fire protection rating, and where rated, shall be self-closing or automatic closing by smoke detection in accordance with Section 716.2.6.1 Door Closing, shall be installed in accordance with NFPA 80 and shall comply with Section 716.
         7) The door assembly shall have an integrated standby power supply.

8) The door assembly power supply shall be electrically supervised.
9) The door shall open to the minimum required width within 10 seconds after activation of the operation device.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
   1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:
   1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
   2. Damaged products will not be accepted.

C. Storage and protection:
   1. Products shall be stored in a dry, protected area.
   2. Products shall be stored in locked storage building.

1.7 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written materials standard warranty:
      a. Warranty Period One (1) Year.

C. Installer's Warranty:
   1. In accordance with the terms of the Specification Section - WARRANTIES:
      a. Warranty period One (1) Year.
      b. Upon project completion and acceptance, the subcontractor shall issue Owner a warranty against defective workmanship and materials.

1.8 OWNER'S INSTRUCTIONS

A. Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train the Owner's maintenance personnel as specified below:
   1. Test and adjust controls and any safeties. Replace damaged or malfunctioning controls and equipment.

1.9 MAINTENANCE

A. Maintenance Service:
   1. Starting at the date of Substantial Completion, provide full maintenance of units for a period of three (3) months on a weekly surveillance basis, followed by nine (9) months on a monthly surveillance basis.
      a. Correct operational imperfections and restore or replace defective or deteriorated components and finishes.
      b. Use only genuine parts, components, and supplies as used in the manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified Operator manufacturer, or approved equivalent:
   a. HORTON “UltraClean Sterile" Vision Lite O-SX / SX-O
   b. HORTON “UltraClean Atmospheric II” O-SX / SX-O with muntin.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Extruded Aluminum ASTM B 221 "Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes," 6063-T5 alloy and temper, anodized.

1. Structural Header Sections:
   a. Minimum 1/8" (3 mm) thickness; capable of self-support of transom glass above.
2. Structural Frame Sections Minimum 1/8" (3 mm) thickness.
3. Structural Panel Sections Commercial grade.

2.3 MANUFACTURED UNITS

A. Manufactured Door Units: Shall include operator, header and track, jambs, sliding door panel(s).

1. Slide-swing panel(s) shall slide along exterior side.
2. Operator: Maximum current draw shall not exceed 3.15 amps. The operator shall be mounted and concealed within the header.
   a. Operating force shall be accomplished through a 1/8 HP DC permanent magnet motor with worm gear transmission and 1800 RPM working with drive belt, attached door hangers, and idler pulley. Drive belt to be steel reinforced nylon, 3/4" wide. Idler pulley to be reinforced, metallic material.
   b. Microprocessor Master Control shall have Version 2 software and have dual on-board seven-segment diagnostic display. The control shall have a minimum 28 programmable parameters including those functions required by ANSI A 156.10. Control shall include separate day and night modes of operation with security over-ride. Adjustable Reversing Circuit will reopen door unit if closing path is obstructed. Maximum force required to prevent sliding panel from closing = 28lbf.
   c. Finger Safety: When unit slides open, strike rail of sliding panel will stop short of adjacent sidelite; resulting opening is net slide.
   d. On/Off Switch shall be supplied. When switched OFF, unit reverts to free manual operation (likewise during electrical power failure).
3. Security and Safety Power Fail Options:
   a. Automatic Lock: Automatically locks slide function of door when in closed position. Additional power supply for autolock not acceptable.
      1) Autolock Fail Secure: If power fails the lock engages.
4. Header: Shall be 8" deep by 6" high aluminum construction with removable face plate.

5. Header Track: Shall be aluminum and replaceable. Rollers will be non-metallic, high quality ball bearing wheels 1-3/4" diameter. Anti-Derailing shall be accomplished by means of a separate adjustable roller.
6. Sliding Panel(s) and Sidelite(s): Shall be aluminum, 1-3/4" deep with Medium stile construction. Weather-stripping to be along perimeter of sliding panel(s) and swing-out sidelite(s). Concealed guides to stabilize bottom of sliding panel. Standard glazing prep to be for ¼" glass.
   a. Total Weight limit per panel shall be:
      1) 156 lbs. for UL Listed slide-swing panel.
7. Emergency Egress: Slide-swing panels can swing out 90 degrees from any position of slide movement and require no more than 50 lbf. of force applied at the lock stile to open.
   a. Slide-swing panels and swing-out sidelites shall have torsion spring designed to re-close panel if pushed open in the direction of egress.
   b. Breakout mechanism shall provide support across full width of the door, in normal operating mode. In breakout mode, torsion assembly shall support weight if the door to minimize drop during emergency egress.
   c. Slide-swing panels and swing-out sidelites shall include intermediate horizontal rail.
   d. Units with emergency egress feature are UL Listed as an exit way and are compliant with NFPA 101.
8. Jambs / Frame: Shall be aluminum. Jamb dimensions to be:
   a. 1-3/4" deep by 6" wide.
9. Threshold: Shall be aluminum, 1/2" tall by 7" wide.
10. Hardware: Provided and installed in strike rail shall be:
    a. Hardware Options:
       1) Flush Panic Exit Device. Recessed in muntin bar.

B. Basic Sensor System: Shall be 24 VDC, class II circuit and shall be adjusted and installed in compliance with ANSI A 156.10. System shall include the following:
1. Activation sensors: Microwave or active infrared sensor shall be header-mounted each side of door unit for detection of traffic from each direction.

2.4

2.4 FABRICATION

A. Operator Construction:
1. Electromechanical.

2.5 FINISHES

A. General:
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
3. Class II, Clear 204-R1 Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
   1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
   2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
   3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
   2. Coordinate installation with Specification Sections - HARDWARE and Division 26 - ELECTRICAL sections.
B. Protection:
   1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
C. Surface preparation:
   1. Prepare surface in accordance with manufacturer's instructions and recommendations.
   2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

3.3 INSTALLATION

A. General:
   1. In accordance with manufacturer's instructions and recommendations unless specifically noted otherwise.
   2. In accordance with approved submittals.
   3. In accordance with Regulatory Requirements.
   4. Set plumb, level, and square.
B. Layout:
   1. Lines shall be straight and true.
C. Installation:
   1. General:
      a. Verify that door units were set plumb, level and true to line, without warp or rack of frames or sash with manufacturer's prescribed tolerances.
   2. Dissimilar Materials:
      a. Comply with AAMA 101, Appendix "Dissimilar Materials" by separating aluminum materials and other corrodible surfaces from sources of corrosion or electrolytic action contact points.
   3. Install Silicone Engineered Transitions in accordance with manufacturer's written instructions.
   4. Weather-Tight Construction:
      a. Verify that header and framing members were set in a bed of sealant or with joint filler or gaskets. Coordinate installation with wall flashings and other components of construction.
   5. Electrical:

a. General or electrical contractor to install all wiring to operator on a separate circuit breaker routed into header.

3.4 ADJUSTING

A. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

3.5 CLEANING

A. Clean in accordance with Specification Section - TEMPORARY FACILITIES AND CONTROLS.
   1. Clean any soiled surfaces immediately.
   2. Finish shall be clean and ready for the application of any additional finishes.
   3. In accordance with manufacturer's instructions and recommendations.

3.6 DEMONSTRATION

A. In accordance with Specification Section - PROJECT CLOSEOUT.
   1. Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train Owner's maintenance personnel as specified below.
      a. Schedule training with the Owner's maintenance personnel with at least seven (7) days advance notice.
      b. Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance.
      c. Review data in "Operating and Maintenance Manuals". Refer to Specification Section - PROJECT CLOSEOUT.

3.7 PROTECTION

A. Protection from traffic:
   1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

END OF SECTION

SECTION 08 70 00 – HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all Building Hardware materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 30 00 CAST-IN-PLACE CONCRETE
4. 05 12 00 STEEL AND FABRICATIONS
5. 06 10 00 ROUGH CARPENTRY
6. 06 22 00 MILLWORK
7. 06 41 23 MODULAR CASEWORK
8. 07 92 00 SEALANTS
9. 08 11 00 METAL DOORS AND FRAMES
10. 08 14 16 WOOD DOORS
11. 08 17 00 INTEGRATED DOOR ASSEMBLIES
12. 08 33 00 COILING DOORS
13. 09 67 23 RESINOUS FLOORING
14. 09 91 00 PAINTING
15. 10 05 00 MISCELLANEOUS SPECIALTIES
16. 32 31 13 CHAIN LINK
17. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP for alarm systems and power interface.

1.2 REFERENCES

A. Standards:

1. In accordance with the following standards:
   a. ADA-S Americans with Disabilities Act 2010 Standards.
   b. ASAHC American Society of Architectural Hardware Consultants.
   c. BHMA Builders Hardware Manufacturers Association.
   d. DHI Door and Hardware Institute.
   e. HMMA Hollow Metal Manufacturer's Association.
   f. NFPA National Fire Protection Association.
   g. UL Underwriter's Laboratories.
   h. WH Warnock Hersey.

1.3 DEFINITIONS

A. The following definitions apply to this Specification Section:

1. AFF Above Finished Floor.
2. LABEL Shall mean "FIRE DOOR ASSEMBLY" as defined in CBC Section 702.
3. LDW Less Door Width.
4. NRP Non Removable Pin.
5. POT Path of Travel (as defined by DSA/ACS and the CBC).

1.4 COORDINATION

A. Floor-Recessed Door Hardware: Coordinate layout and installation with floor construction.

1. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field-verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.5 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
1. Coordination Drawings:
a. Submit installer's coordination drawings indicating the work of this section with that of related work of other sections for proper interface of the completed work. Installer shall coordinate and obtain approvals from the work of other related sections prior to submitting to the Architect.
2. Product Data.
a. Submit manufacturer's technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish (including any custom colors), and other information necessary to show compliance with requirements.
b. Provide Key Control System submittal for review prior to fabrication or ordering. Submit manufacturer's full color range (including any standard, premium and custom colors) for selection by the Architect.
c. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled
3. Shop Drawings – (Hardware Schedule):
a. Submit shop drawings (Hardware Schedule) showing fabrication and installation of the work of this section including plans, elevations, sections, details of components, and attachments to other units of work. Include the following information:
1) Type, style, function, size and finish of each Hardware Item.
2) Name and manufacturer of each item.
3) Fastenings and other pertinent information.
4) Location of each hardware set cross-referenced to indications on the drawings both on the floor plans and in door and frame (opening) schedule as prepared by the Architect.
5) Explanation of all abbreviations, symbols, and codes contained in schedule.
6) Mounting locations for hardware.
7) Door and frame sizes and materials.
8) Keying information.

b. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
c. Furnish as-built/as-installed schedule with close-out documents, including keying schedule, wiring/riser diagrams, manufacturers' installation, adjustment and maintenance information.

4. Quality Assurance/Control Submittals:
   a. Certificates:
      1) Submit three (3) copies of certificates.
      2) Provide a letter on Contractor's Letterhead certifying work provided, meets or exceeds, the requirements of this Section.
         a) Provide a statement on the certificate that all hardware has been furnished in accordance with the Contract Documents.
         b) Provide a statement on the certificate that all hardware has been installed correctly and in proper working order.
5. Closeout Submittals:
   a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
   b. Operation Data in accordance with Specification Section - PROJECT CLOSEOUT.
   c. Record Documents in accordance with Specification Section - RECORD DOCUMENTS.
   d. Warranty in accordance with Specification Section - WARRANTIES.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
   2. Manufacturer/Supplier Qualifications:
      a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
      b. Firm must be a recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project, and that employs an experienced Architectural Hardware Consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.
         1) Responsible for detailing, scheduling and ordering of finish hardware.
         2) Supplier shall meet with the Owner to finalize keying requirements and to obtain final instructions in writing.
         3) Stock parts for products supplied and be capable of repairing and replacing hardware items found defective within warranty periods.

B. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
      a. CBC General Requirements:
         1) Buildings on a K-12 Public School Campus shall be provided with locks which allow doors to classrooms and any room with an occupant load of five or more persons to be locked from the inside per CFC 1010.1.11.
            a) Locks shall conform to the specification and requirements of Section 1010.1.9.

b) Exceptions include doors which are normally locked from the outside, relocatable moved within the same campus, and reconstruction projects.

2) Adjust closers so that beginning from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum, per CBC Section 11B-404.2.8.1.

3) Where Flush Bolts occur in the POT, they shall be Automatic Flush Bolts (accessible).

4) Lever handles shall return to within 1/2 inch off door face.

5) Hand-activated hardware shall be mounted between 34" to 44" AFF; lever-type hardware, panic bars, push-pull activating and lever for thumb-turn dead bolt hardware shall comply with CBC Section 11B-308 Reach Ranges and 11B-404.2.7 Door and Gate Hardware.

a) All hand activated hardware shall be easy to operate with one hand, without tight grasping, pinching, or twisting of the wrist to operate; the force required to activate operable parts shall be 5 pounds maximum, per CBC 11B-309.4.

6) Force for pushing or pulling doors shall be a maximum of 5 lbs at exterior and interior doors per CBC Section 11B-404.2.9.

7) Thresholds in the POT shall be in conformance with CBC Section 11B-404.2.5.

8) All rated doors are to be positive latching and self-closing.

9) All 20 minute rated assemblies shall be provided with approved gasketing material so installed to provide a seal where the door meets the stop on both sides and across the top.

10) Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.

a) Where emergency exit devices are required on fire-rated doors, (with supplementary marking on door's UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware."

11) Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

C. Certificates:

1. Provide a letter on Contractor's Letterhead certifying work provided, meets or exceeds, the requirements of this Section.

1.7 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Conference participants must include Installer's Architectural Hardware Consultant and Owner's security consultant.

B. Keying Conference: Conduct conference at Project site.

1. Conference participants must include Installer's Architectural Hardware Consultant and Owner's security consultant.
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system, including, but not limited to, the following:

a. Flow of traffic and degree of security required.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Requirements for access control.
e. Address for delivery of keys.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
1. Products shall be individually wrapped.
2. Packaging of door hardware shall be the responsibility of the supplier.
a. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule.
1) Two or more identical sets may be packaged in same container.
3. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage. Damaged products will not be accepted at final inspection.

B. Acceptance at Site:
1. Products shall be labeled also with model numbers, catalog numbers, function and finish, identification related to final hardware schedule, and include basic installation instructions with each item or package.
2. Damaged products will not be accepted.

C. Storage and protection:
1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.
2. Provide secure lock-up for door hardware delivered to the Project, but not yet installed.
a. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.9 WARRANTY

A. Contractor's General Warranty, in accordance with Specification Section – WARRANTIES.

B. Manufacturer's Warranty, in accordance with manufacturer's written standard warranty:
1. Closers: Ten (10) Years.
a. Exception: Electronic Closers Two (2) Years.
2. Exit Devices: Ten (10) Years.
3. All other hardware: Ten (10) Years.

C. Installer's Warranty, in accordance with the terms of the Specification Section – WARRANTIES:
1. Warranty period One (1) Year.

1.10 MAINTENANCE

A. Extra Materials:
1. Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified product manufacturer, or approved equivalent:
   - a. Hinges, Butts and Pivots — IVES.
     - 1) Acceptable alternative manufacturers
       - a) HAGER HINGE CO.
       - b) STANLEY HARDWARE.
       - c) McKINNEY.
   - b. Cylinders and Locks (Locksets) — SCHLAGE LOCK DIV.
   - c. Bolts — IVES.
     - 1) Acceptable alternative manufacturers
       - a) GLYNN-JOHNSON CORP.
       - b) TRIMCO.
       - c) BBW.
       - d) DCI.
   - d. Exit / Panic Devices. — VON DUPRIN.
   - e. Push / Pull Units — IVES.
     - 1) Acceptable alternative manufacturers
       - a) TRIMCO.
       - b) BBW.
       - c) DCI.
   - f. Door Control Devices — IVES.
     - 1) Acceptable alternative manufacturers
       - a) GLYNN-JOHNSON CORP.
       - b) TRIMCO.
   - g. Door Trim Units — IVES.
     - 1) Acceptable alternative manufacturers — TRIMCO.
   - h. Door Stops, General — IVES.
     - 1) Acceptable alternative manufacturers
       - a) TRIMCO.
       - b) BBW.
       - c) DCI.
   - i. Kick, Mop and Armor Plates — IVES.
     - 1) Acceptable alternative manufacturers — TRIMCO.
   - j. Door Weatherstripping and Sound / Smoke Seals — PEMKO MANUF. CO.
     - 1) Acceptable alternative manufacturers — NATIONAL GUARD.
   - k. Thresholds — ZERO.
     - 1) Acceptable alternative manufacturers
       - a) PEMKO MANUF. CO.
       - b) NATIONAL GUARD.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. General:

1. Base Metals: Produce hardware units of basic metal and forming method indicating using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified within this specification section for applicable hardware units for finish designations indicated.
2. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.
3. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
4. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners.
    a. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely.

2.3 MANUFACTURED UNITS

A. Hinges:

1. General:
    a. Templates: Provide only template-produced units.
    b. Provide Phillips flat-head screws complying with the following requirements:
        1) For metal doors and frames, install machine screws into drilled and tapped holes.
        2) Finish screw heads shall match surface of hinges or pivots.
2. Butt:
    a. Provide hinge pins as follows:
        1) Out-Swing Exterior Doors — Nonremovable pins.
        2) Out-Swing Corridor Doors with Locks — Nonremovable pins.
        3) Interior doors — Nonrising pins.
        4) Tips: Provide flat button and matching plug, finished to match leaves.
    b. Provide the number of hinges indicated, but not less than the following guidelines:
        1) Doors with heights up to 60 inches — 2 Hinges.
        2) Door with heights 61 to 90 inches — 3 Hinges.
        3) Doors with heights 91 to 120 inches — 4 Hinges.
        4) For doors with heights more than 120 inches, provide four hinges, plus one additional hinge for every 30 inches of door height greater than 120 inches.
    c. Hinges shall be sized in accordance with the following:
        1) Height:
            a) Doors up to 41" wide — 4-1/2 inches.
            b) Doors 42" to 48" wide — 5 inches.
        2) Width: Sufficient to clear frame and trim when door swings 180 degrees.

B. Lock Cylinders and Keying:

1. Lock Cylinders:
    a. Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.
2. Keying:

a. Review the keying system with the Owner and provide the type required (Master, grandmaster or great-grandmaster), either new or integrated with the Owner's existing keying system.
   1) The Owner's existing Grandmaster System is "Classic" SCHLAGE Keyways.
   2) Equip locks with cylinders for construction-core pin tumbler inserts. Provide only temporary inserts for the construction period, and remove these when directed.
      a) Provide final cores and keys prior to Architect's initial punch list.
b. Key Blanks: Provide Standard "6" pin bow key blank; tag to identify.
c. Provide keys manufactured from nickel silver only.
d. Supply keys and blanks as follows:
   1) Supply 2 cut change keys for each different change key code.
   2) Supply 1 uncut key blank for each change key code.
   3) Supply 6 cut master keys for each different master key set.
   4) Supply 4 uncut key blanks for each master key set.
e. Comply with Owner's instructions for masterkeying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks.
   1) Permanently inscribe each key with number of lock that identifies cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE."

C. Locks, Latches, and Bolts:
1. All doors shall be operable from within, without the use of a key by merely rotating the latching handle.
2. All doors in areas used by students shall be self-releasing type, operable from within without the use of a key or special knowledge or effort.
3. Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.
4. Lock Protectors:
   a. Lock astragals shall be provided with internally threaded fasteners for flat head machine screws. No hex head or carriage bolt fasteners will be permitted.
   b. Must be through bolted to door.
5. Provide 5/8 inch minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on fire rated fire openings.
   a. Provide 1/2 inch minimum throw of latch for other bored and preassembled types of locks
   b. Provide 3/4 inch minimum throw of latch for mortise locks.
   c. Provide 1 inch minimum throw for all dead bolts.
6. Provide flush bolt heads a minimum of 1/2 inch diameter rods of brass, bronze, or stainless steel with minimum 12 inch long rod for doors up to 7'-0" in height.
   a. Provide longer rods as necessary for doors exceeding 7'-0" in height.
   b. Automatic Flush Bolts shall be of the low operating force design. Utilize the top bolt only model for interior doors where applicable and as permitted by testing procedures.
   c. Manual Flush Bolts only permitted on storage or mechanical openings as scheduled.
   d. Provide dust-proof strikes at openings using bottom bolts.
7. Provide keyed dogging devices on doors equipped with exit devices.
   a. Do not provide keyed exit devices on fire rated doors equipped with exit devices.
8. Where rabbeted door stiles are indicated, provide special rabbeted front on lock and latch units and bolts.
9. Locksets and Latchsets in Acoustical Doors And Frames require a 3-3/4" backset; verify and coordinate.

10. All egress doors shall comply with AB 211 (2009-2010).

D. Exit / Panic Devices:
   1. Panic hardware shall comply with CCR Title 24, Part 12, Chapter 12-10-302 (a).
      a. The release mechanism shall be so designed that a horizontal force of 15 lbs. or less will actuate the release bar and latches applied in the direction of travel.
   2. No surface mounted vertical rods are allowed.
   3. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 standards.
   4. Device shall bear UL label for fire and or panic as may be required.
   5. Removable Mullions:
      a. Removable with single turn of building key, and securely reinstalled without need for key.
      b. All removable mullions shall be steel or aluminum clad steel whether or not the opening is fire-rated or not.
   6. No manual Flush Bolts on egress doors.

E. Push / Pull Units:
   1. Provide manufacturer's standard exposed fasteners for installation, thru-bolted for matched pairs but not for single units.

F. Closers and Door Control Devices:
   1. Door closer cylinders shall be of high strength cast iron construction with double heat treated pinion shaft to provide low wear operating capabilities of internal parts throughout the life of the installation.
      a. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory.
      b. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
   2. Except as otherwise specifically indicated, comply with manufacturer's written recommendations for size of door control unit depending on size of door, exposure to weather, and anticipated frequency of use.
      a. Where parallel arms are indicated for closers, provide closer unit one size larger than recommended for use with standard arms.
      b. Effort to operate shall conform to CBC Section 11B-404.2.9 accessibility requirements as follows:
         1) Exterior/Interior doors 5.0 pounds maximum.
            a) The Authority having Jurisdiction may increase the maximum effort to operate Fire Doors to achieve positive latching, but not to exceed 15 lbs maximum.
   3. Where manual closers are indicated for doors required to be accessible, provide adjustable units complying with ANSI A 117.1 and CBC Section 11B-404.2.8 provisions for door opening force and delayed action closing.
   4. Where combination door closers and holders are indicated, provide units designed to hold door in an open position under normal usage and to release and close door automatically under fire conditions.
      a. Incorporate an integral electromagnetic holder mechanism designed for use with UL listed fire detectors, provided with normally closed switching contacts.
      b. When indicated, provide integral smoke detector device in combination door closers and holders complying with UL 228, Second Edition.
   5. Provide gray resilient parts for exposed bumpers.
   6. Closures indicated for use on Acoustical Doors and Frames shall allow for a minimum 1/2" up-down movement due to the Cam-Lift hinges.

G. Floor Closers:
   1. Shall be equipped with compression springs, cam and roller operating mechanism and a one piece spindle-cam for maximum operating performance and longevity.

H. Kickplates:

1. Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.
2. Fabricate edge trim of stainless steel to fit door thickness in standard lengths or to match height of protection plates.
3. Fabricate protection plates not more than 1-1/2 inches less than door width on hinge side and not more than 1/2 inch less than door width on pull side by height indicated.
   a. Protection plates shall be stainless steel, 0.050 inch (18 gage).

I. Door Stops:
1. Coordinate the installation of backing in walls with the door supplier, aligned with the top and bottom of doors.
2. Unless otherwise noted in Hardware Sets, provide wall type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
3. Floor Stops shall be installed within four (4) inches maximum from the face of wall, bollard or partition.
4. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.

J. Seals:
1. Provide continuous weatherstripping on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled.
   a. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
   b. Provide silicone gasket at all rated and exterior doors, in accordance with ASTM E 283 "Test method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen."
2. Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.
3. Provide silencers for hollow metal frames, 3 for single doors, 2 for pairs of doors.
   a. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

K. Thresholds:
1. Provide standard metal threshold unit of type, size, and profile as shown or scheduled.
2. Exterior Doors: Provide units not less than 4 inches wide, formed to accommodate change in floor elevation, fabricated to accommodate door hardware and to fit door frames.

L. Door Shoes & Door Top Caps: Provide galvanized door shoes at all exterior wood doors and galvanized top caps at all exterior out-swing doors.

M. Fasteners:
1. Furnish all necessary fasteners required to securely anchor all hardware in position for heavy use and long life. Fastener types and sizes to be per hardware manufacturer's recommendations, suitable for fastening to material to which hardware is applied. Fastener materials and finishes to match hardware items. At no time are self-tapping / threading fasteners allowed on panic/exit hardware or any of the device's parts including strike plate.

N. Fastener Types:
1. To Wood: Phillips flat head, countersunk wood screws, full-threaded.
2. To Metal: Phillips flat head, countersunk machine screws, full-threaded.
3. Butt Hinges: Phillips flat head, countersunk wood screws, full-threaded.
4. Strikes, Face Plates and Similar Items: Phillips flat head, countersunk.
5. Push-Pull and Kick Plates Phillips oval head.
6. Closer and closer shoes to doors and panels-above-doors.
7. Thru-Bolts and Grommets (sex-bolts), sleeved.
8. Panic hardware to doors. Thru-Bolts and Grommets (sex-bolts), sleeved.
9. Self-Tapping sheet metal screws Do not use.
10. Screws at Interior Doors and Frames To match hardware finish.
11. Screws at Exterior Doors and Frames US26D Stainless Steel.

2.4 FINISHES

A. Hardware finishes:

1. General:
    a. All hardware shall be satin chromium (US26D – 626) unless otherwise noted.
    b. Provide push plates, pull plates and kick or armor plates in satin stainless steel (US32D – 630) unless otherwise noted.
    c. Door closers shall be powder-coated to match other hardware, unless otherwise noted.
    d. Aluminum items shall be finished anodized aluminum (US28 – 628), except thresholds which can be furnished as standard mill finish.
2. Match items to the manufacturer's standard color and texture finish for the latch and lock sets (or push-pull units if no latch or lock sets).
3. Provide finishes that match those established by BHMA or, if none established, match Architect's sample.
4. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
5. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze, and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer."
6. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. Finishes shown by certain manufacturers for their products.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
    a. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed in writing by the manufacturer.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:

1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
    a. Coordinate electrical power needs for those hardware items requiring electrical interface.
    b. Coordinate electrical alarm needs (security, fire/smoke detection) for those hardware items requiring electrical alarm interface.
2. Provide all required hardware templates.

B. Surface preparation:

1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
2. Coordinate the blocking required for all wall mounted hardware.

3. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

3.3 INSTALLATION

A. General:

1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
    a. Hardware distributor shall assist and advise installer in correcting field problems arising during installation of hardware.
    b. Hardware distributor shall be on the Project within 48 hours upon being notified by the Contractor.
    c. Hardware distributor shall assist installer in the proper adjustment of all door closers, and other operating devices.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by the Architect.
    a. Steel Doors and Frames: "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
    b. Door opening devices shall be installed at 34" minimum to 44" AFF maximum height per CBC Section 11B-404.2.7. Coordinate height to avoid overlaying vision glass.
5. Install each hardware item in compliance with the manufacturer's written instructions and recommendations. Where indicated and where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 09 Sections.
    a. Do not install surface-mounted items until finishes have been completed on the substrate involved.
6. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
7. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
8. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Specification Section - SEALANTS.
9. Weatherstripping and seals shall comply with manufacturer's written instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Inspection:

1. Contractor shall inspect all hardware to assure that it was installed correctly and is in proper working order.
2. The Contractor shall schedule an inspection prior to substantial completion, and notify the Owner's Inspector and any regulatory agencies of the time 48 hours prior to the inspection.
    a. The inspection shall cover checking all locks and verifying that they have been installed in accordance with the hardware schedule and the keying schedule.

3.5 ADJUSTING

A. Adjusting:

1. Adjust and check each operating item of hardware and each door to ensure proper operations or function of every unit.
    a. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
        1) Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area.
        2) Clean operating items as necessary to restore proper function and finish of hardware and doors.
        3) Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.6 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
    1. Clean any soiled surfaces immediately.
    2. Finish shall be clean and ready for the application of any additional finishes.

3.7 DEMONSTRATION

A. In accordance with Specification Section - PROJECT CLOSEOUT.
    1. Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train Owner's maintenance personnel as specified below.
        a. Provide the services of a factory-authorized service representative to demonstrate and train Owner's maintenance personnel as specified below.
            1) Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.

3.8 SCHEDULES

A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.
B. While the hardware schedule is intended to cover all doors, and other movable parts of the building, and establish type and standard of quality, the contractor is responsible for examining the Plans and Specifications and furnishing proper hardware for all openings whether listed or not. If there are any omissions in hardware groups in regard to regular doors they shall be called to the attention of the Architect prior to bid opening for instruction; otherwise, list will be considered Complete. No extras will be allowed for omissions.
C. The Door Schedule on the Drawings indicates which hardware set is used with each door.

Manufacturers Abbreviations

GLY	=	Glynn-Johnson	Overhead Stops
IVE	=	Ives	Hinges, Flush Bolts, Door Stops & Kick Plates
LCN	=	LCN	Door Closers & Automatic Operators
SCH	=	Schlage Lock	Locks, Latches & Cylinders
VON	=	Von Duprin	Exit Devices, Power Transfers & Electric Strikes
ZER	=	Zero International	Thresholds, Gasketing & Weather-stripping
LOC	=	Locinox	Site Gate Closer

HW GROUP NO. 01

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 X 154	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QELX-PA-AX-99-EO	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QELX-PA-AX-99-L-NL-06	626	VON
1	EA	MULLION STORAGE KIT	MT54	689	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURF. AUTO OPERATOR	9563 REG2 MS AS REQ (120/240 VAC)	ANCLR	LCN
2	EA	ACTUATOR	8310-836T	630	LCN
1	EA	BOLLARD POST	8310-866FLA		LCN
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	SET	WEATHERSTRIP	SEALS BY DOOR/FRAME MFR		
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER
1	EA	POWER SUPPLY	PS902 900-4RL 120/240 VAC		VON
		CARD READER	BY WORK OF DIVISION 28		

HW GROUP NO. 02

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 X 154	689	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-PA-AX-99-EO	626	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-PA-AX-99-L-M996-06-FSE	626	VON
1	EA	MULLION STORAGE KIT	MT54	689	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
2	EA	OVERHEAD STOP	100S ADJ	630	GLY
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA	689	LCN
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	SET	WEATHERSTRIP	SEALS BY DOOR/FRAME MFR		
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON
		CARD READER	BY WORK OF DIVISION 28		

HW GROUP NO. 03

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 X 154	689	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-PA-AX-99-EO	626	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-PA-AX-99-L-M996-06-FSE	626	VON
1	EA	MULLION STORAGE KIT	MT54	689	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON
		CARD READER	BY WORK OF DIVISION 28		

HW GROUP NO. 04

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-PA-AX-99-L-M996-06-FSE	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON
		CARD READER	BY WORK OF DIVISION 28		

HW GROUP NO. 05

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	VANDL EU MORTISE LOCK	LV9092TEU 06A RX 12/24 VDC	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA	689	LCN
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	SET	WEATHERSTRIP	SEALS BY DOOR/FRAME MFR		
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER
		CARD READER	BY WORK OF DIVISION 28		
		POWER SUPPLY	BY WORK OF DIVISION 28		

HW GROUP NO. 06

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM LOCK	LV9080T 06A	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 07

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	REMOVABLE MULLION	KR4954 X 154	689	VON
1	EA	PANIC HARDWARE	PA-AX-99-EO-WH	628	VON
1	EA	PANIC HARDWARE	PA-AX-99-L-NL-06-WH	628	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 08

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224XY	628	IVE
1	EA	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2	626	IVE
1	EA	VANDL STOREROOM LOCK	LV9080T 06A	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT (ON ACTIVE LEAF ONLY)	689	LCN
2	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	ASTRAGAL	43SP	SP	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

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HW GROUP NO. 09

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	REMOVABLE MULLION	KR4954 X 154	689	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-PA-AX-99-EO	626	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-PA-AX-99-L-M996-06-FSE	626	VON
1	EA	MULLION STORAGE KIT	MT54	689	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON
		CARD READER	BY WORK OF DIVISION 28		

HW GROUP NO. 10

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	EU MORTISE LOCK	L9092TEU 06A RX 12/24 VDC	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	AUTO DOOR BOTTOM	355AA(HM) OR 360AA(WD)	AA	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER
		CARD READER	BY WORK OF DIVISION 28		
		POWER SUPPLY	BY WORK OF DIVISION 28		

HW GROUP NO. 11

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	EU MORTISE LOCK	L9092TEU 06A RX 12/24 VDC	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	AUTO DOOR BOTTOM	355AA	AA	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER
		CARD READER	BY WORK OF DIVISION 28		
		POWER SUPPLY	BY WORK OF DIVISION 28		

HW GROUP NO. 12

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	EU MORTISE LOCK	L9092TEU 06A RX 12/24 VDC	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
		CARD READER	BY WORK OF DIVISION 28		
		POWER SUPPLY	BY WORK OF DIVISION 28		

HW GROUP NO. 13

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	EU MORTISE LOCK	L9092TEU 06A RX 12/24 VDC	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	OH STOP & HOLDER	90H	630	GLY
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	GASKETING	188SBK PSA	BK	ZER
		CARD READER	BY WORK OF DIVISION 28		
		POWER SUPPLY	BY WORK OF DIVISION 28		

HW GROUP NO. 14

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	EU MORTISE LOCK	L9092TEU 06A RX 12/24 VDC	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	GASKETING	188SBK PSA	BK	ZER
		CARD READER	BY WORK OF DIVISION 28		
		POWER SUPPLY	BY WORK OF DIVISION 28		

HW GROUP NO. 15

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/IND	L9056T 06A L583-363 OS-OCC	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 16

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 06A	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 17 - HARDWARE BY COOLER/FREEZER DOOR MANUFACTURER

HW GROUP NO. 18 - HARDWARE BY SLIDING DOOR MANUFACTURER

HW GROUP NO. 19 - HARDWARE BY COILING DOOR MANUFACTURER

HW GROUP NO. 20 – HARDWARE BY ROLLING GATE MANUFACTURER

HW GROUP NO. 21

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	GATE CLOSER & HINGE	MAMMOOTH 180		LOC
			BALANCE OF HARDWARE BY GATE FABRICATOR		

END OF SECTION

SECTION 088000 – GLASS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Provide all material, labor, equipment and services necessary to completely install all glass materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
1. DIVISION 00 SPECIFICATION SECTIONS.
2. ALL DIVISION 01 SPECIFICATION SECTIONS.
3. 06 22 00 MILLWORK
4. 07 92 00 SEALANTS
5. 08 11 00 METAL DOORS AND FRAMES
6. 08 14 16 WOOD DOORS
7. 08 41 00 STOREFRONTS
8. 09 91 00 PAINTING
9. 10 05 00 MISCELLANEOUS SPECIALTIES
10. 10 14 00 IDENTIFYING DEVICES
11. 10 28 13 TOILET ACCESSORIES
12. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:
1. In accordance with the following standards:
a. AAMA American Architectural Manufacturers Association.
b. ANSI American National Standards Institute.
c. ASTM American Society for Testing and Materials.
d. CSPC Consumer Products Safety Commission.
e. FGMA Flat Glass Marketing Association Glazing Manual, 1990 Edition.
f. GANA Glass Association of North America
g. GTA Glass Tempering Association.
h. IGCC Insulating Glass Certification Council.
i. LSGA Laminated Safety Glass Association.
j. SGCC Safety Glazing Certification Council.
k. SIGMA Sealed Insulating Glass Manufacturers Association.

1.3 DEFINITIONS

A. Manufacturer is used in this Section to refer to a firm that produces primary glazing, fabricated glazing, or both as defined in the referenced glazing standards.

1. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written directions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
2. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written directions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated glass standard.
3. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed the manufacturing process and not to causes other than glass breakage and improper practices for maintaining, and cleaning insulating glass contrary to manufacturers written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on the interior surfaces of glass.
4. f.o.b. – "Free On Board".
5. Glass Surfaces:
    a. Single Glazed:
        1) Surface #1: exposed to outdoors.
        2) Surface #2: exposed to indoors.
    b. Dual Glazed:
        1) Exterior Lite:
            a) Surface #1: exposed to outdoors.
            b) Surface #2: faces insulating "air" space. Primary location for energy efficient coatings.
        2) Interior Lite:
            a) Surface #3: faces insulating "air" space. Secondary location for energy efficient coatings.
            b) Surface #4: exposed to indoors.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: It is the intention of this specification and the drawings to form a guide for a completely sealed glazing system. Any items not specifically noted but necessary for a completely sealed glazing system shall be provided under this section.
1. Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure, including loss or glazing breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.
2. Glass Design: Glass thickness indicate minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:
    a. Minimum glass thickness for lites in exterior walls shall be not less than 6.0mm (1/4" nom.).
3. Thermal Movement: Provide glazing that allows for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures acting on glass-framing members and glazing components. Base engineering calculation on material's actual surface temperatures due to both solar heat gain and nighttime sky heat loss.
    a. Temperature Change Range: 120 deg F, ambient; 180 deg F, material surfaces..

1.5 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Coordination Drawings:
      a. Submit installer's coordination drawings indicating the work of this section with that of related work of other sections for proper interface of the completed work. Installer shall coordinate and obtain approvals from the work of other related sections prior to submitting to the Architect.
   2. Product Data.
      a. Submit manufacturer's product data for each glazing product and accessory material indicated.
   3. Samples.
      a. Provide 12 inch square sample of each glass type, color and pattern selected.
      b. Provide 6 inch square samples of insulated glazing panels for each glazing type and pattern selected.
      c. Provide 12 inch long samples of each type of glazing sealant, gasket or glazing tape. Install sealant or glazing material sample between two strips of material representative in color of the adjoining framing system.
   4. Quality Assurance/Control Submittals:
      a. Test Reports:
         1) Compatibility and Adhesion Test: From sealant manufacturer indicating that glazing sealants were tested for adhesion to glass and glazing channel substrates and compatibility with glass and other glazing material.
      b. Certificates:
         1) Contractor's Certification.
         2) Qualification Data:
            a) Material Qualifications.
            b) Installer Qualifications.
            c) Manufacturer/Supplier Qualifications.
         3) Product Certificates:
            a) Fire-Resistive Ceramic Glazing materials.
      c. Manufacturer's Written Instructions:
         1) Manufacturer's written installation instructions for all products.
   5. Closeout Submittals in accordance with the following:
      a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
      b. Record Documents in accordance with Specification Section - RECORD DOCUMENTS.
      c. Warranty in accordance with Specification Section - WARRANTIES.
         1) Special Warranties:
            a) Coated Glass Products.
            b) Laminated Glass Products.
            c) Insulated Glass Products.
            d) Insulated Glazing Products.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Material Qualifications:
      a. Comply with published recommendations of glazing product manufacturers and organizations listed, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

b. Obtain glazing from one source for each product indicated.

2. Installer Qualifications:
   a. An experienced Installer who has completed three (3) projects similar in materials, design and extent to that indicated for this Project; whose work has resulted in glass installation with a record of successful in-service performance..
3. Manufacturer/Supplier Qualifications:
   a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
   a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA), in the area where the project is located.
   b. All glazing shall comply with provisions of CBC Chapter 24 for quality standards and CBC Section 2403.1 for identification.
   c. All glazing subject to Hazardous Locations shall comply with Safety Glazing Requirements and CBC Chapter 2406.

C. Certificates:
1. Contractor's Certification: Provide a letter on Contractor's Letterhead certifying work provided, meets or exceeds, the Code Minimum requirements, and the other specified requirements of this Section.
2. Qualification Data: Contractor's installation certificates.
3. Product Certificates: Glazing materials manufacturers certifying that their products comply with specified requirements.
4. Fire-Resistive Ceramic Glazing materials certification that products comply with CPSC Requirements.

D. Meetings:
1. Pre-Installation: Schedule prior to the start of work.
   a. Coordinate the work with other work being performed.
   b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
   c. Pre-glazing conference: Scheduled by the Contractor prior to the start of any glazing operation for the proper performance of the work.
      1) Minimum agenda shall be to review the work required; discuss field observations, problems, and decisions; corrective measures if necessary; and maintenance of quality and work standards in accordance with manufacturer's warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
   a. Review for proper installation of work progress.
   b. Identify any installation problems and acceptable corrective measures.
   c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
   a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
   b. Maintaining installed work until the Notice of Substantial Completion has been executed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.
a. Protect glazing materials to comply with manufacturer's written directions and as needed to prevent damage to glazing and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
2. Where insulating glass units will be exposed to substantial altitude changes, comply with insulating glass fabricator's recommendations for venting and sealing to avoid hermetic seal ruptures.

B. Acceptance at Site:
1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
2. Damaged products will not be accepted.

C. Storage and Protection:
1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.8 PROJECT CONDITIONS

A. Environmental Requirements:
1. Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.
a. Do not install liquid sealants when ambient and substrate temperature conditions are outside of limits by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer’s Warranty:
1. In accordance with manufacturer's written standard warranty.
2. Manufacturer's Warranty on Coated Glass Products:
a. Submit written warranty signed by coated glass manufacturer agreeing to replace coated glass units that deteriorate as defined in "Definitions" article, f.o.b. the nearest shipping point of Project Site, within specified warranty period.
b. Warranty Period: Five (5) Years.
1) From date of Substantial Completion.
3. Manufacturer's Warranty on Laminated Glass Products:
a. Submit written warranty signed by insulating glass manufacturer agreeing to replace laminated glass units that deteriorate as defined in the "Definitions" article, f.o.b. the nearest shipping point of Project Site, within specified warranty period.
b. Warranty Period: Five (5) Years.
1) From date of Substantial Completion.
4. Manufacturer's Warranty on Insulating Glass Products:

a. Submit written warranty signed by manufacturer of insulating glass agreeing to replace insulating glass units that deteriorate as defined in "Definitions" article, f.o.b. the nearest shipping point of Project Site, within specified warranty period.
b. Warranty Period: Ten (10) Years.
1) From date of Substantial Completion.

5. Manufacturer's Warranty on Insulated Glazing Panels:
a. Submit written warranty signed by manufacturer of Insulating Glazing Panels agreeing to replace Insulating Glazing Panels that deteriorate due to crazing, cracking, color fading and delamination under ordinary conditions.
b. Warranty Period: Twenty (20) Years.
1) From date of Substantial Completion.

C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES:
a. Warranty period One (1) Year.
1) From date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
1. Specified Annealed Float Glass product manufacturer, or approved equivalent:
a. Class 1 materials:
1) VITRO ARCHITECTURAL GLASS (formerly PPG INDUSTRIES, INC.).
2) Acceptable Alternative Class 1 Manufacturers:
a) AFG INDUSTRIES, INC.
b) CARDINAL GLASS INDUSTRIES.
c) GUARDIAN INDUSTRIES CORPORATION
d) PILKINGTON SALES (NORTH AMERICA) LTD.
b. Class 2 materials, Pyrolytic Coated (On-Line Process):
1) VITRO ARCHITECTURAL GLASS (formerly PPG INDUSTRIES, INC.), "Graylite" Tinted Glass.
2) Acceptable Alternative Class 2 Pyrolytic (On-Line) manufacturers:
a) AFG INDUSTRIES, INC.
b) PILKINGTON SALES (NORTH AMERICA) LTD.
2. Specified Glazing Tapes and other Accessory manufacturer, or approved equivalent:
a. TREMCO, Glass Tapes "440 Tape".
b. Acceptable Alternative Accessory Manufacturer:
1) ADCO "ADCOSEAL GT-1 or GT-4".

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. General:
1. All glazing shall comply with all provisions of CBC Chapter 24.
   a. Provide the required strength of glazing to comply with the area limitation set forth in CBC Table 2403.2.1 for individual lites.
2. Refer to the Glass Schedule of this section for the class of each Glazing Type.
3. Refer to the Insulating Glazing Panel Schedule of this section for the class of each Insulated Glazing Panel Type.

B. Annealed Float Glass: ASTM C 1036 "Specification for Flat Glass", Type I, and and ASTM C 1048 "Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass", Type (transparent glass, flat), Quality q3 (glazing select), of Class indicated.

C. Heat-Treated Float Glass: ASTM C 1048 "Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass", Type I (transparent glass, flat), Quality q3 (glazing select), of class, kind and condition indicated.
1. Fabrication Process: By vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option, except provide horizontal process where indicated as tongless or free of tong marks.
2. Provide Kind HS (Heat-Strengthened) float glass in place of annealed float glass where needed to resist thermal stresses indicated by differential shading of individual glass lites and to comply with glass design requirements.
3. Uncoated Glass: Comply with the requirements for Condition A.
4. Coated Glass: Comply with the requirements for Condition C.
5. Tempered: Provide Kind FT (Fully Tempered) float glass in place of annealed or Kind HS (Heat Strengthened) float glass where safety glass is indicated.

D. Ceramic-Coated Spandrel Glass: ASTM C 1048 "Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass", Condition B (spandrel glass, one surface ceramic coated), Type II (tinted flat glass), Quality-Q3, and complying with other requirements specified.
1. Fallout Resistance: Provide spandrel units identical to those passing the fallout-resistance test for spandrel glass specified in ASTM C 1048 "Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass"..

E. Insulated Glass:
1. General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated inter-space, and complying with ASTM E 774 "Specification for the Classification of the Durability of Sealed Insulating Glass Units", of Class CBA units and with requirements specified.
2. Provide Kind HS (Heat-Strengthened) float glass in place of annealed glass where needed to resist thermal stresses inducted by differential shading of individual glass lites and to comply with glass design requirements.
3. Tempered: Provide Kind FT (Fully Tempered) glass where safety glass is indicated.
4. Overall Unit Thickness and Thickness of each lite dimension indicated for insulating glass units are nominal and the overall thickness of units are measured perpendicular from outer surfaces of glass lites at unit's edges.
5. Sealing System: Dual seal with primary and secondary sealants as follows:
   a. Manufacturers standard sealants.
6. Spacer: Manufacturers standard spacer material and construction, compatible with dehydrating gas filler.

2.3 ACCESSORIES

A. Elastomeric Glazing Sealants:
1. General: Provide products of type indicated, complying with the following requirements:
   a. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials they will contact, including glazing products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
   b. Suitability: Comply with sealant and glazing manufacturer's written recommendations for selecting glazing sealants and tapes that are suitable for applications indicated and conditions existing at time of installation.
   c. Colors: Provide color of exposed joint sealants to comply with the following:
      1) Match colors indicated by reference to manufacturer's standard designations.
      2) Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.
2. Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with ASTM C 920 "Specification for Elastomeric Joint Sealants", requirements indicated in Specification Section - SEALANTS, including those referencing ASTM classifications for Type, Grade, Class and Uses.

B. Glass Tapes:
1. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent, non-staining and non-migrating in contact with nonporous surfaces, with or without spacer rod as recommended in writing by tape and glazing manufacturers for application indicated, packaged on rolls with a release paper backing, and complying with ASTM C 1281 "Specification for Preformed Tape Sealants for Glazing Applications", and AAMA 800 "Voluntary Specifications and Test methods for Sealants" for products indicated below:
   a. AAMA Section 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

C. Miscellaneous Glass Materials:
1. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glass materials involved for glass application indicated, and with a proven record of compatibility with surfaces contacted in installation.
2. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
3. Setting Blocks: Elastomeric material with a Shore Type A durometer hardness of 85 plus or minus 5.
4. Spacers: Elastomeric blocks or continuous extrusions with a Shore Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
5. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).
6. Plastic Foam Joint Fillers: Pre-formed, compressible, resilient, nonstaining, nonextruding, nonoutgassing, strips of closed-cell plastic foam of density, size, and shape to control sealant depth and otherwise contribute to produce optimum sealant performance.
7. Perimeter Insulation for Fire-Resistive Glass: Identical to product used in test assembly to obtain fire-resistive rating.

2.4 FABRICATION

A. Fabricate glass and other glass products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instruction and recommendations of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. Clean cut or flat grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

C. Grind smooth and Polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
   1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
      a. Examine glass framing, with glazier present, for compliance with the following:
         1) Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
         2) Presence and functioning of weep system for aluminum framing systems, and proper sealing of hollow metal frame systems with no weep systems.
         3) Minimum required face or edge clearances.
         4) Effective sealing between joints of glass-framing members.
   2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
   3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:
   1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

C. Surface preparation:
   1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
   2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.
   3. Clean glass channels and other framing members receiving glass immediately before glazing.
   4. Remove coatings that are not firmly bonded to substrates.
   5. Wipe down any mirror backing with alcohol before applying mirror adhesives.

3.3 INSTALLATION

A. Glass, General:
1. Comply with installation standards of CBC Chapter 24.
   a. Glass subject to human impact shall be installed in accordance with CBC 2406.
2. Comply with combined written instructions and recommendations of manufacturers of glass, insulated glass panels, sealants, gaskets, and other glass materials, except where more stringent requirements are indicated, including those in referenced glazing publications.
3. Glass channel dimensions, as indicated on Drawings, provide necessary bite on glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
4. Protect glass from edge damage during handling and installation as follows:
   a. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
   b. Remove damaged glass from Project site and legally dispose of off site. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.
5. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
6. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
7. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
8. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:
   a. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glass tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
   b. Provide 3.0mm (1/8" nom.) minimum bite of spacers on glass and use thickness equal to sealant width. With glass tape, use thickness slightly less than final compressed thickness of tape.
9. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.
10. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

B. Tape Glazing:
1. Position tapes on fixed stops so that when compressed by glass their exposed edges are flush with or protrude slightly above sight-line of stops.
   a. Slightly recess tape at exterior conditions, and continuously cap bead with elastomeric sealant leaving no open joints.
2. Install tapes continuously but not in one continuous length.
   a. Do not stretch tapes to make them fit opening.
3. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs.
4. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.
5. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped.
6. Do not remove release paper from tape until just before each lite is installed.
7. Seal joints in tapes with compatible sealant approved by tape manufacturer.

a. Apply continuous heal bead of elastomeric sealant at all exterior hollow metal framing stops.
b. Install a continuous toe bead of elastomeric sealant at all exterior hollow metal framing stops on installations with Laminated Glass, Wire Glass or Insulated Glazing Panels.
c. Apply continuous cap bead of elastomeric sealant over exposed edge of tape.

8. Install tapes on all fixed and loose stops.

C. Sealant glazing (Wet):
1. Install continuous spacers between glass lites and glass stops to maintain glass face clearances and to prevent sealant from extruding into glass channel weep systems (if any) until sealants cure.
a. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
2. Force sealant into glass channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
3. Tool exposed surfaces of sealants to provide a substantial wash away from glass.
a. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

3.4 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
1. Wash glass on both faces in each area of Project not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion.
a. Wash glass as recommended in writing by glazing manufacturer.

3.5 PROTECTION

A. Protection from traffic:
1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.
2. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass.
a. Do not apply markers to glass surface.
b. Remove nonpermanent labels, and clean surfaces.
3. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter.
a. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended in writing by glass manufacturer.
4. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended in writing by glass manufacturer.
5. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.

3.6 SCHEDULES

A. Glass Schedule:

B. **"C" -- Clear Float Glass:**

1. C1-1 -- Clear Float, Class 1, manufactured by VITRO ARCHITECTURAL GLASS:
   a. Thickness 6.00 mm (Approx. 1/4" nominal).
   b. Minimum Visible Light (%) Transmittance 89.
   c. Solar Heat Gain Coefficient (SHGC) 0.81.
   d. "U" Factor:
      1) Winter Night-time 1.03.
      2) Summer Daytime 0.93.
2. C1-1T -- Tempered Clear Float, Class 1, manufactured by VITRO ARCHITECTURAL GLASS:
   a. Thickness 6.00 mm (Approx. 1/4" nominal).
   b. Minimum Visible Light (%) Transmittance 89.
   c. Solar Heat Gain Coefficient (SHGC) 0.81.
   d. "U" Factor:
      1) Winter Night-time 1.03.
      2) Summer Daytime 0.93.
3. C2-2 -- Heat Strengthened, Clear Float + Clear Float:
   a. Thickness 25.00 mm (1" nominal).
   b. Insulated Glazing Unit System:
      1) Outdoor Lite: 1/4" HS Clear Float.
         a) Heat Treated, per ASTM C1048 Kind HS.
         b) Surface #2 Coating SN 54.
      2) Interspace: 1/2 Inch.
         a) Spacer Material: Manufacturer's standard.
         b) Content: Air.
      3) Indoor Lite: 1/4" HS Clear Float:
         a) Heat Treated, per ASTM C1048 Kind HS.
   c. Visible Light Transmittance 54.
   d. Solar Heat Gain Coeffiecient (SHGC) 0.28.
   e. "U" Factor:
      1) Winter Night-time 0.29.
      2) Summer Daytime 0.27.
4. C2-2S -- Heat Strengthened, Clear Float + Clear Float with Interior Surface Treated Gray Frit (Spandrel):
   a. Thickness 25.00 mm (1" nominal).
   b. Insulated Glazing Unit System:
      1) Outdoor Lite: 1/4" HS Clear Float.
         a) Heat Treated, per ASTM C1048 Kind HS.
         b) Surface #2 Coating SN 54.
      2) Interspace: 1/2 Inch.
         a) Spacer Material: Manufacturer's standard.
         b) Content: Air.
      3) Indoor Lite: 1/4" HS Clear Float:
         a) Heat Treated, per ASTM C1048 Kind HS.
   c. Solar Heat Gain Coeffiecient (SHGC) 0.28.
   d. "U" Factor:
      1) Winter Night-time 0.29.
      2) Summer Daytime 0.27.
5. C2-2ST -- Tempered Clear Float + Clear Float with Interior Surface Treated Frit (Spandrel):
   a. Thickness 25.00 mm (1" nominal).
   b. Insulated Glazing Unit System:
      1) Outdoor Lite: 1/4" HS Clear Float.

a) Heat Treated, per ASTM C1048 Kind FT.
b) Surface #2 Coating SN 54.

2) Interspace: 1/2 Inch.
a) Spacer Material: Manufacturer's standard.
b) Content: Air.

3) Indoor Lite: 1/4" HS Clear Float:
a) Heat Treated, per ASTM C1048 Kind FT.

c. Solar Heat Gain Coeffiecient (SHGC) 0.28.
d. "U" Factor:
1) Winter Night-time 0.29.
2) Summer Daytime 0.27.

6.

7. C2-2T -- Tempered Clear Float + Clear Float:
a. Thickness 25.00 mm (1" nominal).
b. Insulated Glazing Unit System:
1) Outdoor Lite: 1/4" Clear Float.
a) Heat Treated, per ASTM C1048 Kind FT.
b) Surface #2 Coating SN 54.

2) Interspace: 1/2 Inch.
a) Spacer Material: Manufacturer's standard.
b) Content: Air.

3) Indoor Lite: 1/4" Clear Float
a) Heat Treated, per ASTM C1048 Kind FT.

c. Visible Light Transmittance 54.
d. Solar Heat Gain Coeffiecient (SHGC).. 0.28.
e. "U" Factor:
1) Winter Night-time 0.29.
2) Summer Daytime 0.27.

END OF SECTION

SECTION 09 22 16 – METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all metal framing materials (both Cold-Formed Framing and Light gage Metal Framing), accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 15 14 DRILLED ANCHORS
4. 03 30 00 CAST-IN-PLACE CONCRETE
5. 04 22 00 CONCRETE MASONRY UNITS
6. 05 12 00 STEEL AND FABRICATIONS
7. 05 30 00 METAL DECK
8. 06 10 00 ROUGH CARPENTRY
9. 06 41 23 MODULAR CASEWORK
10. 07 21 00 INSULATION
11. 07 40 00 METAL PANELS
12. 07 51 13 BUILT-UP ROOFING
13. 07 60 00 SHEET METAL
14. 07 72 00 ROOF ACCESSORIES
15. 07 84 00 FIRESTOPPING
16. 07 92 00 SEALANTS
17. 08 11 00 METAL DOORS AND FRAMES
18. 08 14 16 WOOD DOORS
19. 08 33 00 COILING DOORS
20. 09 24 00 CEMENT PLASTER
21. 09 29 00 GYPSUM BOARD
22. 09 30 00 TILE
23. 09 50 00 ACOUSTICAL CEILINGS
24. 10 05 00 MISCELLANEOUS SPECIALTIES
25. 10 14 00 IDENTIFYING DEVICES
26. 10 44 00 FIRE PROTECTION SPECIALTIES
27. 11 40 00 FOOD SERVICE EQUIPMENT
28. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. In accordance with the following:

1. AISI American Iron and Steel Institute
2. ASTM American Society for Testing Materials
3. AWS American Welding Society
4. ICC International Code Council.

1.3 DEFINITIONS

A. Minimum Uncoated Steel Thickness: Minimum uncoated thickness of metal framing delivered to the Project site shall be not less than 95 percent of the thickness used in the metal framing design. Lesser thicknesses shall be permitted at bends due to cold forming.

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1.4 SYSTEM DESCRIPTION

A. Performance Requirements: It is the intention of this section and the drawings to form a guide for a complete framing system. Any items not specifically noted but necessary for a complete framing system shall be provided under this section.
   1. Wall systems shall accommodate tolerances, deflection of building structural members, and clearances of intended openings.
   2. Fire-Test-Response Characteristics: Where indicated, provide metal framing materials and construction identical to that of assemblies tested for fire resistance.
      a. Per ASTM E 119 "Test methods for Fire Tests of Building Construction and Materials" by a testing and inspecting agency acceptable to Authorities Having Jurisdiction (AHJ), products used in the assembly shall carry a classification label from a testing laboratory acceptable to the AHJ.

1.5 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product Data: For each type of product indicated.
      a. Materials list of items proposed to be provided under this section.
   2. Quality Assurance/Control Submittals:
      a. Test Reports:
         1) Current ICC ES Report.
         2) Welding inspection report per DSA/SS "T & I" List.
      b. Certificates:
         1) Welding certificates indicating qualifications.
         2) Mill certificates, per ICC AC46 "Acceptance Criteria for Cold-Formed Steel Framing Members", indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, and metallic-coating thickness. Comply also with CBC Section 202A.1.
      c. Manufacturer's Written Instructions:
         1) Manufacturer's written recommended installation procedures shall become the basis for accepting or rejecting actual installation procedures on the work.
   3. Closeout Submittals in accordance with the following:
      a. Warranty in accordance with Specification Section –WARRANTIES.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Material Qualifications:
      a. Galvanized and carbon sheet steel products formed from steel with a minimum yield stress of 33 ksi for 18 gage and lighter member and 50 ksi for 16 gage and heavier members.
      b. All products shall be engineered to meet the latest Edition of the American Iron and Steel Institute (AISI), "North American Specification for the Design of Metal Steel Structural Members".
      c. All products manufactured shall comply with the CBC and AISI, and shall have a current ICC Evaluation Service Report (ICC ESR).
         1) AISI "Code of Standard Practice for Cold-Formed Steel Structural Framing".
   2. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
      b. Welders shall be qualified for welding in horizontal, vertical, and overhead positions in accordance with AWS D1.3.
   3. Manufacturer/Supplier Qualifications:

a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. In accordance with Specification Section - REGULATORY REQUIREMENTS.

C. Meetings:

1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
   a. Coordinate the work with other work being performed.
   b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
   a. Review for proper installation of work progress.
   b. Identify any installation problems and acceptable corrective measures.
   c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
   a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
   b. Maintaining installed work until the Notice of Substantial Completion has been executed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. General: Steel Framing and related accessories shall be stored and handled in accordance with AISI "Code of Standard Practice for Cold-Formed Steel Structural Members".

B. Packing, shipping, handling, and unloading:

1. Products shall be handled in such a manner as to assure that they are free from corrosion, deformation, dents, scratches and other damage.

C. Acceptance at Site:

1. Products must be in manufacturer's original unopened bundles and containers with labels indicating brand name, size, and grade.
2. Damaged products will not be accepted.

D. Storage and protection:

1. Metal Framing and related accessories shall be stored and handled in accordance with the AISI "Code of Standard Practice".
2. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
   a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.8 PROJECT CONDITIONS

A. Existing Conditions:

1. Examine project and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Field Measurements: Take and be responsible for field measurements as required. Report any significant differences between field dimensions and the contract document conditions to Architect.
3. Carefully coordinate work under this Section with that of the structural framing sections and details so that the interface between structural framing and non structural framing shall provide the lines and degree of finish shown and specified.

1.9 WARRANTY

A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty, in accordance with manufacturer's written standard warranty:

a. Warranty Period One (1) Year.

C. Installer's Warranty in accordance with Specification Section – WARRANTIES:
1. Warranty period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
1. Studs, Tracks, Ceiling Joists, Channels and Steel Accessories specified product manufacturer:
a. CLARK DIETRICH BUILDING SYSTEMS, LLC (CDBS).
b. Acceptable alternative manufacturers:
1) CEMCO.
2) SCAFCO.
3) STUDCO.
2. Slotted Deflection Track and Vertical Deflection Clip accessories specified product manufacturer, unless otherwise noted:
a. BRADY INNOVATIONS "SLP-TRK" Slotted Deflection Track.
b. CLARK DIETRICH BUILDING SYSTEMS, LLC (CDBS).
1) Vertical Deflection Clips:
a) "Fast Top Clips"
b) "Fast Clip Slide Clips
c) "Quick Clip"
d) "Slide Clip
c. Acceptable alternative manufacturers:
1) CEMCO.
2) SCAFCO.
3) STUDCO.
3. Shaftwall specified product manufacturer:
a. CLARK DIETRICH BUILDING SYSTEMS, LLC (CDBS).
b. Acceptable alternative manufacturers:
1) CEMCO.
2) SCAFCO.
3) STUDCO.
4. Flat Strap and Backing Plate:
a. CLARK DIETRICH BUILDING SYSTEMS, LLC (CDBS):
1) "DanBack" Fire Treated Wood Backing Plate.
b. Acceptable alternative manufacturers:
1) CEMCO.
2) SCAFCO.
3) STUDCO.
5. Channel Bridging or Bracing:
a. CLARK DIETRICH BUILDING SYSTEMS, LLC (CDBS):
1) "Spazzer 9200" Bridging and Spacer bar.
2) "EasyClip" and "U-Series" Clip Angle.
b. Acceptable alternative manufacturers:
1) CEMCO.
2) SCAFCO.

3) STUDCO.

6. Pony Wall Support Post:
   a. CLARK DIETRICH BUILDING SYSTEMS, LLC (CDBS):
      1) “Pony Wall Heavy”
7. Metal screw specified product manufacturer:
   a. GRABBER CONSTRUCTION PRODUCTS.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Steel Sheet:
   1. Steel sheet for 16 gage and heavier shall comply with ASTM A 1003 "Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members," structural steel classification, Grade 50 ksi, Class 1 or 2.
   2. Steel sheet for 18 gage and lighter shall comply with ASTM A 1003 "Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members," structural steel classification, Grade 33 ksi, Class 1 or 2.
   3. When hot-rolled steel sheet and strip is used in fabrication of metal members they shall comply with ASTM A1011 "Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength," structural steel classification, Grade 50 ksi.

B. Coating:
   1. Steel sheet shall be galvanized in accordance with ASTM A 1003 "Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members," G60 minimum and comply with ASTM A 924 "Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process."
      a. Vertical Deflection Clips shall be in accordance with ASTM A 1003 "Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members," G90 minimum and ASTM A 924 "Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process."
   2. When hot-rolled steel sheet and strip is used in fabrication of metal members, hot-dip galvanize coating shall be in accordance with ASTM A 123 "Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."

C. Thickness:

REFERENCE GAGE	MILS	MINIMUM BASE METAL THICKNESS (INCH)	MINIMUM DESIGN THICKNESS (INCH)
20	33	0.0329	0.0346
18	43	0.0428	0.0451
16	54	0.0538	0.0566
14	68	0.0677	0.0713
12	97	0.0966	0.1017
10	118	0.1180	0.1240

2.3 COMPONENTS

A. Studs: Manufacturer's standard C-shaped steel studs, punched, with stiffened flanges, complying with ASTM C 645 "Specification for Nonstructural Steel Framing Members."

B. Track: Manufacturer's standard U-shaped steel track, unpunched, with unstiffened flanges, complying with ASTM C 645 "Specification for Nonstructural Steel Framing Members."
   1. Slotted Deflection Track: Manufacturer's single, 20 gage minimum, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges with vertical slotted holes, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads.
      a. Product, or approved equivalent, must be approved by DSA/SS.

b. Slotted Deflection Track must be rated for both 1 and 2 hour "T" and "F" Fire-Rated Assemblies.

2. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
   a. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads.

C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure.

D. Ceiling Joists: Manufacturer's standard C-Shaped steel sections, with stiffened flanges, complying with ASTM C 645 "Specification for Nonstructural Steel Framing Members."

E. Channels: In sizes as shown in the Contract Documents:
   1. 16 gage, 3/4 inch with 1/2 inch flange 300 lbs/1000 feet weight.
   2. 16 gage, 1-1/2 inch with 17/32 inch flange 500 lbs/1000 feet weight.
   3. 16 gage, 2 inch with 17/32 inch flange 590 lbs/1000 feet weight.

F. Shaftwall: Manufacturer's standard shapes for fire-rated assemblies and complying with ASTM C 645 "Specification for Nonstructural Steel Framing Members." Shapes shall be 20 gage minimum, unless noted otherwise.
   1. Track: Manufacturer's standard J-Runner Shaped Track (JR), tabbed, with un-stiffened flanges.
   2. Studs: Manufacturer's standard C-H (CH), E-S (ES), I-S (IS) Shaftwall Studs, punched with stiffened flanges.
   3. Jamb Strut: Manufacturer's standard corner and Jamb Strut (JS), un-punched, with un-stiffened flanges.

G. Flat Strap and Backing Plate: Galvanized Steel Sheet for blocking and bracing in length and width required.
   1. Standard Backing shall be 16 gage minimum and continuous. Notch backing at studs.

H. Channel Bridging or Bracing:
   1. U-Channel Assembly per ASTM C 645 "Specification for Nonstructural Steel Framing Members," Base Metal Thickness of 0.0538 inch and minimum 1/2 inch wide flanges.

I. Steel Accessories: Fabricate Backing, Bridging, Clip Angles, Strap and Shapes in configurations shown and in compliance with ASTM C 645 "Specification for Nonstructural Steel Framing Members."
   1. Standard Backing shall be 16 gage minimum and continuous. Notch backing at studs.

2.4 ACCESSORIES

A. Fasteners:
   1. Metal Screws: Provide corrosion-resistant-coated, self-drilling or self-tapping steel screws complying with ASTM C 1513 "Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections" and ICC ESR 2196 "HILTI Self-Drilling and Self-Piercing Screws."
      a. Provide low profile "Truss Head" framing screws so that subsequent substrates lay flat over fasteners.
   2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 "Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members" conducted by a qualified independent testing agency.
   3. Expansion Anchors: Refer to Specification Section – DRILLED ANCHORS.

B. Welding Electrodes: Comply with AWS Standards.

C. Galvanized Repair Paint: Provide product complying with ASTM A 780 "Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings."

D. Drypack Grout: Refer to Specification Section – CAST-IN-PLACE CONCRETE.

E. Pony Wall Support Post: 12 gauge channel post with 3 3/8” x 8” x 1/2" thick base plate. Height as indicated in the Drawings

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
   1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
   2. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
   3. Carefully coordinate all requirements for pipes and other items designed to be housed within the partition, wall or ceiling systems.
   4. Carefully coordinate all requirements for backing support of items to be mounted on finished walls.
   5. Space metal framing as required for compliance with all pertinent regulations, to give proper support for the facing material, and as indicated on the Drawings.

3.2 PREPARATION

A. Protection:
   1. Protect all adjacent surfaces from damage from work under this specification section.
   2. Remove any fireproofing only as much of these materials as needed to complete installation of metal framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

B. Surface preparation:
   1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
   2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.
   3. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

3.3 INSTALLATION

A. General:
   1. In accordance with drawings and manufacturer's written instructions and recommendations, and procedures described in ASTM C 754 "Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products."
   2. In accordance with approved submittals.
   3. In accordance with Regulatory Requirements.
   4. Set plumb, level, and square.
   5. Metal Framing may be shop or field fabricated for installation, or it may be field assembled.

B. Layout:
   1. Lines shall be straight and true.
   2. Install Metal Framing according to ASTM C 754 "Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products," unless more stringent requirements are indicated.

C. Installation:
   1. Install shop or field fabricated, Metal Framing and securely anchor to supporting structure.
      a. Bolt or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch in ten (10) feet.

2. Install Metal Framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements of the Contract Documents.
    a. Cut framing members by sawing or shearing; do not torch cut.
    b. Fasten Metal Framing members by welding or screw fastening. Wire tying of framing members is not permitted.
        1) Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
        2) Locate mechanical fasteners and install, with screw penetrating joined members by not less than three exposed screw threads.
        3) Beneath sheathing provide low-profile screw heads (i.e. "Wafer Head").
        4) Fasten both flanges of studs to track, unless otherwise indicated.
3. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.
4. Punched openings in studs must align when placed in final position.
5. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
6. Install horizontal bridging in wall studs, spaced in rows as indicated on the drawings. Fasten at each stud intersection.
7. Do not bridge building expansion and control joints with Metal Framing. Independently frame both sides of joints.
8. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
9. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
10. Erection Tolerances: Install Metal Framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
    a. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
11. At all sound partitions, set floor runners in two 1/4 inch diameter continuous beads of acoustical sealant as prescribed in Specification Section - SEALANTS.
12. At all smoke barrier partitions, set floor and ceiling runners in two 1/4 inch diameter continuous beads of Class II Flame Spread and Smoke Developed rated acoustical sealant as prescribed in Specification Section - SEALANTS.
13. Install supplementary backing and bracing wherever walls or partitions are indicated to support equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to wall or partition. Comply with stud manufacturer's written instructions and industry standards.
14. Frame wall openings larger than 2-foot square with double stud at each jamb.
15. Install continuous strapping to side of studs that do not receive sheathing at 3'-6" o.c. vertically.

D. Ceiling Joist Installation:
1. Align and install joist track and ceiling joists plumb, square, and true to line bearing on supporting frame. Securely fasten connections according to manufacturer's written recommendations and requirements of the Contract Documents.
2. Install bridging at interval indicated on the drawings. Fasten at each joist intersection.

3.4 REPAIR / RESTORATION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed Metal Framing with galvanized repair paint and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure Metal Framing is without damage or deterioration at time of Substantial Completion.

3.5 FIELD QUALITY CONTROL

A. Site Tests:
   1. As required by Regulatory Requirements.

B. Inspection:
   1. As required by Regulatory Requirements.
   2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
   3. Project Inspector shall verify that all stud cavity walls are free of moisture and dry prior to any other construction that encloses the wall cavity.

END OF SECTION

SECTION 09 24 00 – CEMENT PLASTER

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all Cement Plaster materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS
   2. DIVISION 01 SPECIFICATION SECTIONS
   3. 03 30 00 CAST-IN-PLACE CONCRETE
   4. 04 21 00 THIN BRICK VENEER
   5. 04 22 00 CONCRETE MASONRY UNITS
   6. 04 40 00 STONE VENEER
   7. 06 10 00 ROUGH CARPENTRY
   8. 05 12 00 STEEL AND FABRICATIONS
   9. 05 33 00 METAL DECK
   10. 07 21 00 INSULATION
   11. 07 60 00 SHEET METAL
   12. 07 84 00 FIRESTOPPING
   13. 07 92 00 SEALANTS
   14. 08 11 00 METAL DOORS AND FRAMES
   15. 08 31 13 ACCESS DOORS AND FRAMES
   16. 08 33 00 COILING DOORS
   17. 08 41 00 STOREFRONTS
   18. 09 22 16 METAL FRAMING
   19. 09 30 00 TILE
   20. 09 50 00 ACOUSTICAL CEILINGS
   21. 09 65 10 RESILIENT BASE AND ACCESSORIES
   22. 09 91 00 PAINTING
   23. 10 05 00 MISCELLANEOUS SPECIALTIES
   24. 10 14 00 IDENTIFYING DEVICES
   25. 10 28 13 TOILET ACCESSORIES
   26. 10 44 00 FIRE PROTECTION SPECIALTIES
   27. 11 40 00 FOOD SERVICE EQUIPMENT
   28. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with the following standards:
      a. AAMA American Architectural Manufacturers Association
      b. ASTM American Society of Testing Materials
      c. FS Federal Specification
      d. ML/SFA Metal Lath / Steel Framing Association - a Division of NAAMM.
      e. NAAMM National Association of Architectural Metal Manufacturers.

f. PDSM Plaster and Drywall Systems Manual, ©1988 by BNI and McGraw-Hill, Inc., Third Edition.
g. SSMA Steel Stud Manufacturer's Association.

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
1. Product Data:
a. Manufacturer's Data for each type of product specified.
b. Submit manufacturer's standard color range for selection by the Architect.
c. Manufacturer's full color range (including standard, premium and custom colors) of integral color mixes for selection.
d. Manufacturer's ICC ES Evaluation Reports (ESR) for fasteners as required.
2. Shop Drawings:
a. Show location of all metal accessories: expansion joints, control joints, casing beads, corner reinforcements, separation screeds and reglets.
b. Provide installation details of flashings at various types of penetrations, all metal accessories, metal lath, and integration with other related work.
3. Samples:
a. 24 inch square field sample of each Cement Plaster Finish prepared on rigid backing for selection.
1) Cement Plaster Finish of each pattern and texture selected prior to paint coat.
2) Cement Plaster Finish of each pattern and texture for each color with type of paint coating selected. Coordinate with Specification Section – PAINTING.
b. 6 inch lineal samples of each piece of specified Metal Accessory material as required for the project.
4. Quality Assurance/Control:
a. Installer's experience.
b. Manufacturer's certification of Installers.
c. Manufacturer's installation instructions.
d. Water Tightness Test Reports.
e. Manufacturer's Field Reports:
1) Confirm mixing and installation procedures of proprietary mixes for all coats of the cement plaster system were within manufacturers requirements.
f. Tension Testing Reports.
5. Closeout Submittals in accordance with the following:
a. In accordance with Specification Section - PROJECT CLOSEOUT.
b. Warranty in accordance with Specification Section – WARRANTIES.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Material Qualifications:
a. Proprietary systems data sheets shall include design properties of each product.
2. Installer Qualifications:
a. Installer shall be experienced and shall have successfully completed three (3) projects of similar scope and size to that indicated for this Project.
b. Shall participate in a mock-up installation that was successfully tested for water tightness.

c. Manufacturer of proprietary products shall provide written certification that the Installer is qualified to install manufacturer's systems in accordance with manufacturer's warranty requirements.

3. Manufacturer/Supplier Qualifications:
   a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. In accordance with Specification Section – REGULATORY REQUIREMENTS.

C. Field Samples:
1. Provide Field Samples for approval prior to the application of the cement plaster coats.
2. Field Samples shall be panels of a complete installation, representing each of the finish textures and colors from the approved submittal samples.
   a. The field samples shall be done by the installers for the project.
   b. The approved field samples shall establish the acceptable standards for all subsequent work.
3. When it is the Contractor's intent to incorporate the approved sample panels into the finish Project, the panels shall be located in an area relatively obscured from general view.

D. Mock-Ups:
1. Provide mock-up panels prior to application of cement plaster work and prior to installation of any exterior wall cavity and interior materials.
2. Mock-Up Assemblies:
   a. Mock-Ups shall be at exterior wall assemblies and shall integrate all other related work assemblies, including but not limited to, each type of wall openings, wall/eave interface, wall sill, parapet cap, various types of penetrations, material transitions and shall be representative of the intended end-use configuration.
      1) Mock-Ups shall be a minimum overall size of 10'-0" wide x 8'-0" high.
   b. Mock Ups will be used for establishing construction sequence, installation requirements of materials, and creating water tight assemblies without the cement plaster coats.
   c. Mock Ups may become part of the completed Work upon successful testing for water tightness.
3. Installation:
   a. The Project Inspector, the Architect, Contractor’s Superintendent and Sub-contactor's Superintendent shall observe the installation of materials.
   b. Installation crew for the Mock-Ups shall be the installers of the Cement Plaster Systems for this project and installers, as necessary, of other related work assemblies.
   c. Mock Ups shall include the installation of water barriers, penetration flashing, Metal Accessories, Metal Lath, and other related work flashings and materials.
   d. Failed Mock Ups shall be removed and the assembly reinstalled until the water tightness test is successful.

E. Meetings:
1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
   a. Coordinate the work with all other related work.
   b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
   a. Review for proper installation of work progress.
   b. Identify any installation problems and acceptable corrective measures.
   c. Identify any measures to maintain or regain project schedule if necessary.

3. Completion: Scheduled by the Contractor upon proper completion of the work.
    a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
    b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:
1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
2. Damaged products will not be accepted.

C. Storage and protection:
1. Store materials inside and under cover on a level platform, six (6) inches above ground, to allow air circulation.
    a. Keep dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes.

1.6 PROJECT CONDITIONS

A. Environmental requirements:
1. Temperature: No plastering shall be done under unsuitable conditions of weather or temperature.
    a. Exterior: No plastering shall be done when prevailing temperature is 40 degrees F. or less for the preceding 24 hours prior to plastering, during the plaster operations, and for at least 48 hours after the set of each plaster coat.
        1) Apply and cure plaster to prevent plaster drying out during the curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
    b. Factory-Prepared Finishes: Comply with manufacturers written recommendations for the environmental conditions for application of finishes.

B. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

1.7 WARRANTY

A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
1. In accordance with manufacturer's written standard warranty:
    a. Warranty Period One (1) Year.

C. Installer's Warranty:

1. In accordance with the terms of the Specification Section - WARRANTIES:
   a. Warranty period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Water Barriers:
   a. Building Wrap (also qualifies as an "Air Barrier"):
      1) DuPONT COMPANY.
      2) TYPAR.
   b. Sealing Tape:
      1) DuPONT COMPANY.
      2) Acceptable alternative manufacturers:
         a) CANTECH INDUSTRIES.
         b) 3M COMPANY.
         c) TYPAR.
   c. Building Paper:
      1) FORTIFIBER CORP.
2. Penetration Flashing:
   a. GRACE CONSTRUCTION PRODUCTS.
   b. Acceptable alternative manufacturers:
      1) FORTIFIBER.
3. Expanded Metal Lath:
   a. CLARK DIETRICH BUILDING SYSTEMS, LLC (CDBS).
   b. Acceptable alternative manufacturers:
      1) ALABAMA METAL INDUSTRIES CORPORATION (AMICO).
      2) CEMCO.
4. Wire Fabric Lath :
   a. Woven Wire Fabric Lath:
      1) GEORGETOWN WIRE COMPANY
      2) Acceptable alternative manufacturers:
         a) DAVIS WIRE COMPANY.
         b) JAENSON WIRE COMPANY.
   b. Welded Wire Fabric Lath:
      1) STRUCTA WIRE COMPANY, INC.
5. Metal Accessories:
   a. Galvanized Metal Plaster Accessories:
      1) CLARK DIETRICH BUILDING SYSTEMS, LLC (CDBS).
      2) STOCKTON PRODUCTS (SP).
      3) Acceptable alternative manufacturers:
         a) ALABAMA METAL INDUSTRIES CORPORATION (AMICO).
         b) CEMCO.

b. Aluminum Plaster Accessories:
1) FRY REGLET CORPORATION.
2) Acceptable alternative manufacturers:
a) FLANNERY, INC.
b) PITTCON.
c. Fastener:
1) FLANNERY, INC.
6. Elastomeric Scratch, Brown and Finish Coat Systems:
a. DRYVIT SYSTEMS, INC.
b. Acceptable alternative manufacturers:
1) SONNEBORN.
2) STO.
7. Lath Fasteners:
a. Screw Anchors:
1) POWERS FASTENERS "TAPPER +".
8. Furring Wads for Screws:
1) FLANNERY TRIM INC. "FURRING WADS".

B. Products from other manufacturers not listed must submit in accordance with Specification Section – SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Cement Plaster System:
1. Line Wire: Galvanized steel wire, in accordance with ASTM A 641 "Specification for Zinc-Coated (Galvanized) Carbon Steel Wire."
a. Minimum 18 gage (0.0475 inch).
2. Water Barriers: Water-Resistive Barriers shall be in accordance with CBC Sections 1404.2 and 2510.6:
a. Building Wrap (also qualifies as an "Air Barrier"): Woven and non-woven polyolefin sheets approved per ICC ES Reports for Water-Resistive Barriers for buildings of any construction type and equivalent to Grade D paper with 60 minute water-resistant rating.
1) "Tyvek® Commercial Wrap" by DuPONT COMPANY.
b. Sealing Tape (3" wide minimum):
1) "Tyvek® Housewrap Tape" by DUPONT COMPANY.
2) Accceptable alternative manufacturer:
a) "Clipper Tape" by CANTECH IND.
b) "8086 Construction Sheathing Tape" by 3M.
c. Building Paper:
1) Number 15 Asphalt-Saturated felt complying with Type I felt in accordance with ASTM D226 "Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing."
2) Asphalt-Saturated Kraft Waterproof Building Paper approved per ICC ES Reports for Water-Resistive Barriers for buildings of any construction type and equivalent to Grade D paper with 60 minute water-resistant rating.
3. Penetration Flashing: Self-adhered and self-healing weather barrier strips, in accordance with FS UU-B-790a, Grade A.
a. 40 mil. minimum thickness, in 9-inch and 12-inch widths as is appropriate for barrier application.
1) "VYCOR V40" by GCP APPLIED TECHNOLOGIES.
2) Acceptable alternative manufacturer:

a) "Fort-I-Flash 40" by FORTIFIBER
b) "FlexWrap" and "StraightFlash" by TYVEK.

4. Metal Accessories: Zinc Alloy, Aluminum or Hot-Dipped Galvanized Steel, G-60 minimum (Coordinate depth of trim and accessories with the thicknesses and number of plaster coats).
   a. Control Joints:
      1) 28 gage galvanized steel, depth as required, AMICO No. "GripLock J Control Joint."
   b. Casing Bead:
      1) 26 gage galvanized steel, 1-1/2" x depth as required, CDBS No. 66, Short Flange Casing Bead.
   c. Corner Reinforcement:
      1) Outside Reinforcements:
         a) 26 gage galvanized steel, depth as required, CDBS #1A, Expanded Flange.
      2) Inside Joints:
         a) 28 gage galvanized steel, depth as required, CDBS #30 Construction Control Joint.
   d. Drip Mold:
      1) 24 gage galvanized steel, 2-3/4" x depth as required, SP BSS Blind Spot #10 Drip.
   e. Vents:
      1) 26 gage galvanized steel, 3" x depth as required, SP SBS Bug Stop Vent.
      2) 26 gage galvanized steel, 3" x depth as required, SP SES Ember Stop Soffit Vent.
   f. Foundation Sill Screed: 3-1/2 inch minimum vertical attachment flange per CBC Section 2512.1.2.
      1) 26 gage galvanized steel, 3-1/2" x depth as required, CDBS #FHA7 Foundation Sill Screed, with weep holes.
   g. Weep Screed:
      1) 26 gage galvanized steel, 1-1/2" x depth as required with weep holes, CDBS #66 Short Flange Casing Bead, with weep holes.
   h. Special Trim Shapes, minimum 0.025 extruded aluminum alloy 6063:
      1) Channel Screeds, Reveal Moldings, & Screeds by FRY REGLET:
         a) Provide specific shapes as shown on the Drawings.
         b) Provide manufacturer's standard channel screed "+," "T," "L," and "corners," factory fabricated intersections as required for channel screeds, reveal moldings and screeds.
         c) Provide manufacturer's standard flashing connectors between straight runs and intersections.
         d) Butt Joints shall be flush and align with other metal accessories.
         e) Provide End Caps compatible for all channel screeds, reveal moldings, and screeds that terminate at opening frames and other construction.
         f) All finishes shall be "Special Anodic Coating" clear color.
   i. Single Point Separation Screed:
      1) 26 gage galvanized steel, Expanded Metal Base x depth as required, SP PBS Pointed Base Screed with Keyholes.
   j. Stucco Reglet: 26 gage galvanized steel:
      1) 2-1/2-inch flange by FRY REGLET "STX" Series.
      2) 1-3/4 inch flange by FRY REGLET "ST" Series.
      3) Accessories: Factory manufactured mitered and sealed corners, and polyvinyl chloride "Vinylok" flashing retainer clips.

5. Metal Lath:
   a. Wire Fabric Lath:
      1) Woven: Galvanized steel in accordance with ASTM C 1032, "Specification for Woven Wire Plaster Base," and ASTM C 1066 "Specification for Installation of Lath and Furring to Receive Interior and Exterior Portland Cement-Based Plaster."
         a) 1-1/2 inch x 17 gage (0.0540 inch) hexagon shaped mesh, 1.86 lbs. per square yard.
         b) "Paper Backed" Woven Wire Fabric Lath and "Self-Furring" Woven Wire Fabric Lath are not acceptable.
      2) Welded: Galvanized steel in accordance with ASTM C 933 "Specification for Welded Wire Lath," and ASTM C 1066 "Specification for Installation of Lath and Furring to Receive Interior and Exterior Portland Cement-Based Plaster."
         a) 1-1/2 inch x 1-1/2 inch x 17 gage (0.0625 inch) square shaped mesh, 1.14 lbs. per square yard.
         b) "Paper Backed" Welded Wire Fabric Lath is not acceptable.
         c) "Self-Furring" Welded Wire Fabric Lath without paper backing shall be acceptable.
6. Cement Plaster:
   a. Cement: Type I or II Portland Cement
      1) In accordance with ASTM C 150 "Standard Specification for Portland Cement."
   b. Plastic Cement: Type M or S.
      1) In accordance with ASTM C 1328 "Standard Specification for Plastic (Stucco) Cement."
   c. Miracle Lime: Type S.
      1) In accordance with ASTM C 206 Standard Specification for Finishing Hydrated Lime."
   d. Sand: Clean and washed sand complying with ASTM C 897 "Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters."
      1) Grading:

U.S. STANDARD SIEVE	CUMULATIVE WEIGHT MINIMUM	PERCENT RETAINED MAXIMUM
NO. 4	--	0
NO. 8	0	10
NO. 16	10	40
NO. 30	30	65
NO. 50	70	90
NO. 100	95	100
NO. 200	97	100

      2) Finish Coat Sand: Washed, white silica sand, a.k.a. "Monterey Sand."
   e. Surface Applied Liquid Bonding Agent: Resinous emulsion with the following minimum requirements:
      1) Minimum tensile strength of 60 psi.
      2) Minimum compressive shear strength of 300 psi.
7. Elastomeric Finish Coat:
   a. Primer/base coat:
      1) "WEATHERPRIME" as manufactured by DRYVIT.
   b. Finish coat:

1) "WEATHERLASTIC" as manufactured by DRYVIT.
   a) Factory-formulated, integral color, 100 percent acrylic, "Dirt Pickup Resistant" chemistry, elastomeric binder for bridging hairline cracks.
   b) Coverage: Not greater than 150 sq.ft. per 7 lb pail.
   c) Accelerated Weathering: No deleterious effects after 5,000 hours continuous exposure in accordance with ASTM G 26 "Standard Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials."
   d) Resistance to wind-driven rain: Passes in accordance with Federal Test Method TT-C-555 B.
   e) Resistance to Salt Spray: No deleterious effects after 500 hours continuous exposure in accordance with ASTM B 117 "Standard Practice for Operating Salt Spray (Fog) Apparatus."
   f) Mildew Resistance Passes in accordance with Military Standard 810B.
   g) Fungal Resistance: Passes in accordance with Federal Test Method 141, and Method 6271.
   h) Elongation: 450 percent elongation at break in accordance with ASTM D 412 "Standard Test methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension."
   i) Tensile Strength: 100 psi @ 72 deg. F, 488 psi @ 0 deg. F in accordance with ASTM D 412 "Standard Test methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension."
   j) Flexibility: Passes - no cracking, 1/8" dia. mandrel, 180 deg. bend, done at -30 deg. F in accordance with ASTM D 522 "Standard Test Method for Mandrel Bend Test of Attached Organic Coatings."
   k) Water Vapor Transmission: 15 perms @ 10 mils dry film thickness, Free film, dried 21 days @ 73 deg. F., 50 percent R.H.; Water Method: 50 percent R.H. @ 72 deg. F., non-inverted cup (Method B), in accordance with ASTM E 96 "Standard Test Methods for Water Vapor Transmission of Materials."
   l) Adhesion to Concrete: 125 psi at failure end point, Pull-off test dried 21 days @ 72 deg. F., 50 percent R.H. in accordance with ASTM D 4541 "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers."
   m) Impact Resistance: 98 inch pounds at failure end point in accordance with ASTM D 2794 "Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)."
   n) Shore A Hardness: 70, 20 mils dry film thickness, dried 21 days @ 72 deg. F., 55 percent R.H. in accordance with ASTM D 2240 "Standard Test Method for Rubber Property – Durometer Hardness."
   o) Flame Spread: Class 1, in accordance with ASTM E 84 "Standard Test Method for Surface Burning Characteristics of Building Materials."

c. Color and Texture:
   1) As selected by the Architect from the manufacturer's standard, premium, and custom color palette, and texture finish.

2.3 ACCESSORIES

A. Fasteners: Shall be in accordance with ASTM C 1063, "Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster".
   1. Staples: galvanized steel.

a. In accordance with ASTM E1667 "Standard Specification for Driven Fasteners, Nails, Spikes and Staples."
b. Provide 1/4 inch furring wads at staple attachments for lath.

2. Nails: galvanized steel.
   a. In accordance with ASTM E1667 "Standard Specification for Driven Fasteners, Nails, Spikes and Staples."
   b. Minimum, 7/16 inch (0.437 inch) diameter head and 11 gage (0.1205 inch) barbed, roofing or common nails.
   c. Provide 1/4 inch self-sealing furring wads at nail attachments for lath.
   d. Tie Nails: 10d galvanized nails.
   e. Concrete Stub Nails: Corrosion Resistant.
      1) Minimum, 3/8 inch wide head.
3. Screws at Wood Framing: Corrosion Resistant.
   a. In accordance with ASTM C 1002 "Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs."
      1) Minimum 7/16 inch (0.437 inch) diameter pan wafer head and a 0.163 inch (#8) diameter shank with sharp-point.
   b. Provide 1/4 inch furring wads at screw attachments for lath.
4. Screws at Metal Framing: Corrosion Resistant.
   a. In accordance with ASTM C 954 "Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. to 0.122 in. in Thickness."
      1) Minimum 7/16 inch (0.437 inch) diameter pan wafer head with self-drilling and self-tapping point.
         a) **0.22 inch (#10) diameter shank.**
   b. Provide 1/4 inch furring wads at screw attachments for lath.
5. Power or Powder Actuated Fasteners:
   a. In accordance with ASTM E 488 "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements."
   b. Size: min. 3/8 inch wide heads with 0.145 inch shank diameter, in length as required to achieve specified penetration.
   c. Corrosion Resistant.
6. Screw Anchor Fasteners:
   a. In accordance with ASTM E 488 "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements."
   b. In accordance with valid ICC ESR testing applicable to installation conditions.
   c. Size: 3/16 inch diameter, in length as required to achieve specified penetration.
   d. Corrosion Resistant.
   e. Accessories for Screw Anchor Fasteners:
      1) Matched tolerance drill bit, dust removal device, and other accessories in accordance with written manufacturer's instructions and ICC ES Evaluation Report.
7. Wires:
   a. Galvanized (Class 1 zinc coating) soft temper steel wire, in accordance with ASTM A 641, "Specification for Zinc-Coated (Galvanized) Carbon Steel Wire."
   b. All wire diameters specified are uncoated and corresponds with United States Steel Wire Gauge (USSWG):
      1) Member to Member: Minimum 16 gage (0.0625 inch).
      2) Lath to Support Member: Minimum 18 gage (0.0475 inch).
      3) Lath to Metal Accessories: Minimum 18 gage (0.0475 inch).
      4) Lath to Lath: Minimum 18 gage (0.0475 inch).

B. Open Corner Reinforcement:
   1. Cement Plaster: Expanded Metal Lath, AMICO "Cornalath" galvanzied steel.
   2. Elastomeric Finish Coat: 4" x 9", 15 oz/sq.yd. minimum weight, glass fiber mesh.

2.4 MIXES

A. Cement Plaster Mixes: Shall be in accordance with ASTM C 926 "Specification for Application of Portland Cement-Based Plaster."
   1. Scratch Coat Mix (No additions of plasticizing agents allowed):
      a. One half part Common Cement.
      b. One half part Plastic Cement.
      c. Four parts Sand.
   2. Brown Coat Mix (No additions of plasticizing agents allowed):
      a. One half part Common Cement.
      b. One half part Plastic Cement.
      c. Five parts Sand.
   3. Finish Coat Mix:
      a. Exterior Elastomeric:
         1) Primer/Base Coat.
         2) Finish Coat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
   1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual, which affect the execution of work under this specification section.
   2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
   3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with all related work specified under other sections to ensure proper and adequate interface of work.
      a. Verify and locate framing and or backing necessary for proper installation of cement plaster system.
   2. Integrate Water barriers and Penetration Flashing with all flashings from all other related work for proper shedding of water out of the building.
   3. Protection:
   4. Project Inspector shall verify that all stud cavity walls are free of moisture and dry prior to any other construction that fully closes the wall cavity.
   5. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
      a. Provide temporary protections and enclosures for other work.

B. Surface preparation:

1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

3.3 INSTALLATION

A. General:
   1. It is the intent to provide a weather resistant exterior plaster system envelope upon completion.
      a. Overlap and shingle fashion all substrate barriers, papers and penetration flashing with accessories in such a way as to shed water at the midpoint flashing (i.e. floor juncture flashing, or head flashing at openings and penetrations), or allow it to weep to drainage weep holes at the foundation sill screed in accordance with the requirements of the CBC Section 1403 and 1404.2.
   2. In accordance with ASTM C 1063, "Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster" and ASTM C 926, "Application of Portland Cement-Based Plaster."
      a. In accordance with CBC Chapter 7, Chapter 7A, Chapter 14, and Chapter 25.
      b. In accordance with listed UL Assemblies at designated fire rated assemblies.
      c. In accordance with "The Plaster and Drywall Systems Manual" (PDSM).
      d. In accordance with Regulatory Requirements.

B. Layout:
      a. Set plumb, level, and square.
      b. Lines of all Metal Accessories shall be straight and true. Set accessories to create a cement plaster finish plane within a tolerance of 1/8 inch in 10 feet.
      c. Apply all Brown and Finish Coats of plaster to create a finish plane with a tolerance of 1/8 inch in 10 feet.

C. Installation of Water Barriers:
   1. Install Water Barriers after installation of Line Wire at open framing.
   2. Water barriers shall be installed at all exterior walls, exterior soffits, and at interior walls considered to be "Semi-Wet" and "Wet" exposures (i.e. Toilets, Showers, Lockers, Kitchens and etc.).
   3. Install Water Barriers with Penetration Flashing, Metal Accessories, and all other related work in "shingle" or "weatherboard" fashion.
   4. Water Barriers shall be installed as required in CBC Sections 1404.2, 1404.3, 1405, and 2510.6 as follows:
      a. Provide two layers of Water Barriers.
         1) One inner layer of Building Wrap (also qualifies as an "Air Barrier"):
            a) Seal all laps and penetrations with a 3" wide minimum Sealing Tape.
         2) One outer layer of Building Paper.
      b. The Water Barrier shall be applied horizontally, with the upper layer lapped over the lower layer not less than 6 inches and free from holes and breaks.
         1) Where vertical joints occur, barrier shall be lapped not less than 6 inches.
      c. Exposure:
         1) Maximum exposure of Water Barriers shall be 30 days prior to plaster application or less as required by Water Barrier Manufacturer.
            a) Protect Water Barriers from the elements (both exposure to the sun and water) with a temporary 6-mil visqueen barrier or other material approved by the barrier manufacturer.

D. Installation of Penetration Flashing:

1. Apply Penetration Flashing in conjunction with Water Barriers, Metal Accessories and all other related work.
2. Install Penetration Flashing at all openings and penetrations at all exterior walls and at interior walls considered to be "Semi-Wet" and "Wet" exposures (i.e. Toilets, Showers, Lockers, Kitchens, etc.).
3. Install Penetration Flashings with Water Barriers, Metal Accessories and all other related work in "shingle" or "weatherboard" fashion.
4. Penetration Flashings shall be installed in accordance with CBC in 9" widths and continuous to 9" past all intersections around all openings, penetrations and termination of plaster systems.
   a. Should any penetration warrant a greater width of wall flashing, provide 12" wide flashing as required.
   b. When an object extends through the Cement Plaster System, return the edge of the Penetration Flashing 1" and apply to the sides of the penetrating item.
5. Objects such as electrical back-boxes, electrical speaker enclosures, penetrations created by structural members, and the like.

E. Installation of Metal Accessories:
1. Apply Metal Accessories in conjunction with Water Barriers, Penetration Flashings and all other related work.
2. Install Metal Accessories as required to delineate cement plaster work into areas of the following maximum size and shall be in addition to locations shown on the drawings:
   a. Vertical surfaces 144 sq.ft.
   b. Horizontal and other non-vertical surfaces 100 sq.ft.
   c. Length-to-width ratios of not greater than 2-1/2:1.
   d. Distances not greater than 18 feet.
3. Install Metal Accessories with Water Barriers, Penetration Flashing Sheets and all other related work in "shingle" or "weatherboard" fashion.
4. Install all Metal Accessories in accordance with manufacturer's instructions, and the PDSM.
   a. All Metal Accessories shall be fully supported in accordance with CBC, secure flanges to framing.
   b. Installed in 10 foot lengths wherever possible.
   c. All joints (butt, mitered, bent, continuing around corners, or changing directions) shall be cut accurately, welded, or folded, sealed, pop-riveted and sealed again, for a watertight joint.
      1) Special Trim Shapes joints (butt, "T," "+," "L" and inside/outside intersections) provide manufacturer’s flashing connectors and factory fabricated intersections to connect shapes.
         a) Provide End Caps at all open ends and when terminated at opening frames and all other construction.
         b) Butt Joints shall be flush and align with other metal accessories.
         c) Seal all intersections and ends.
      2) Maintain the water barrier continuously behind any joint.
      3) Joints shall occur at nearest possible expansion or control joints.
   d. When an object extends through the Cement Plaster System, accurately cut and install in "shingle" or "weatherboard" fashion the Metal Accessories around the penetration. Apply sealant between the metal accessories and the penetrating object.
5. Metal Accessories shall be attached to framing members along supports.
   a. **6 inches o.c.** .
   b. Single Point Separation Screeds can be wire tied over Metal Lath.

c. Where dissimilar metals come into surface contact provide electrolytic protection between dissimilar metals using neoprene, plastic sheet, EPDM rubber or other protective coating.

F. Installation of Metal Lath:

1. General:
   a. Apply Metal Lath after the installation of Line Wire, Water Barriers, Penetration Flashings and Metal Accessories.
   b. Install the various types of Metal Lath at the following conditions:
      1) Woven Wire Fabric Lath over Solid Sheathing.
      2) Welded Wire Fabric Lath over Solid Sheathing.
   c. Apply Metal Lath in accordance with all applicable portions of CBC Chapters 7 and 25, and ASTM C 1063 "Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster."
      1) Metal Lath shall be applied with long dimension of sheet perpendicular to the framing members to which it is attached.
         a) All fasteners shall be corrosion resistant equal to or superior to that of the lath.
         b) All lath shall be furred out away from supports and solid substrate at least 1/4 inch.
         c) Lath shall be attached to framing members along framing members except for 3/8-in. rib metal lath shall be attached at each rib **no more than 6 inches o.c.** .
      2) The Metal Lath shall be broken at all metal accessories and cut into panels that are defined by the edges of the cement plaster metal accessories, expansion joints and the like.
         a) Perimeter of the lath panel shall be wire tied to the cement plaster metal accessories.
         b) No joints shall be permitted at any angle or corner.
      3) Lapping of Metal Lath.
         a) Side laps shall be secured to framing members and shall be wire tied between supports with No. 18 gage (0.0475-inch) galvanized annealed steel wire at 9" o.c. maximum.
         b) Where end laps occur between the framing members or between attachments, the end of the metal lath sheets shall be laced or wire tied with No. 18 gage (0.0475 inch) galvanized annealed steel wire.
         c) Expanded Metal Lath shall be lapped 1/2-inch or nest the edge ribs at sides and 1" at ends.
         d) Wire Fabric Lath shall be lapped one mesh at the sides and the ends.
2. Metal Framed Construction:
   a. Horizontal Framing:
      1) Screws shall project not less than 3/8-in. through metal framing member when the lath is installed and shall engage not less than three strands of lath.
         a) Screw attachments at Hi-Rib Lath shall pass through, but not deform rib.
      2) Where Water Barriers are not required, securely attach to metal framing members with No. 18 gage (0.0475 inch) wire ties, clips, hog rings or approved equivalent attachments.
         a) Securely attach Hi-Rib Lath to open-web steel joists by single ties of galvanized, annealed steel wire not less than No. 18 gage (0.0475 inch), with the ends of each tie twisted together 1-1/2 times.
   b. Vertical Framing:

1) Screws shall project not less than 3/8-in. through metal framing members when the lath is installed. and shall engage not less than three strands of lath.
   a) Screw attachments at Hi-Rib Lath shall pass through, but not deform rib.
2) Where Water Barriers are not required (Interior Walls), securely attach to metal framing members with No. 18 gage (0.0475 inch) wire ties, clips, hog rings or approved equivalent attachments.

3. Wire tie laps and metal accessories with expanded metal flanges. Screw anchor fasten accessories with solid flanges.
4. Attach accessories in such a manner as to ensure proper alignment during plaster application.
5. Installation of Security Metal Lath:
   a. Install Security Metal Lath for Custom Steel Fabricated Metal Toilet Partitions.
   b. Weld Security Metal Lath to cold rolled channels as detailed on the drawings.
      1) Security Metal Lath end joints shall be butted and occur over studs; edge joints shall be butted and wire tied between supports.

G. Cement Plaster Installation:
1. General: Each plaster coat shall be applied without interruption to entire wall or ceiling panels to eliminate cold joints and abrupt changes in the uniform appearance of succeeding coats. Panels are defined by naturally occurring interruptions in the plane of the plaster, such as corner angles, rustications, openings, and control joints.
2. Nominal Cement Plaster Thickness over Metal Lath:
   a. At open framing and sheathing substrates, Vertical and Horizontal Surfaces: 7/8" nominal.
      1) Scratch Coat thickness: 3/8".
      2) Brown Coat thickness: 3/8".
      3) Finish Coat thickness: 1/8".
   b. At concrete or masonry substrates, Vertical and Horizontal Surfaces 7/8" nominal.
      1) Scratch Coat thickness: 1/2".
      2) Brown Coat thickness: 1/4".
      3) Finish Coat thickness: 1/8".
3. Nominal Cement Plaster Thickness over Concrete or Masonry Substrates:
   a. Masonry Vertical Surfaces: 1/2" nominal.
      1) Bond Coat: N/A.
      2) Brown Coat thickness 3/8".
      3) Finish Coat thickness 1/8".
   b. Masonry Horizontal Surfaces: 3/8" nominal.
      1) Bond Coat: N/A.
      2) Brown Coat thickness 1/4".
      3) Finish Coat thickness 1/8".
   c. Concrete Vertical and Horizontal Surfaces: 3/8" nominal.
      1) Bond Coat: N/A.
      2) Brown Coat thickness 1/4".
      3) Finish Coat thickness 1/8".
   d. Where the installed plaster thickness over masonry will exceed the nominal 1/2 inch thickness, the plaster system shall be the three coat application over self-furred expanded metal lath.
   e. Where the installed plaster thickness over concrete will exceed the nominal 3/8 inch thickness, the plaster system shall be the three coat application over self-furred expanded metal lath.
4. Scratch Coat Installation:

a. Cover Lath totally and completely with Scratch Coat Mix.
b. Finish: Heavily scratched at right angles to framing members to provide strong mechanical key for Brown Coat.
c. Curing: Continuously moist cure a minimum of 48 hours immediately after installation and prior to application of Brown Coat.

5. Bond Coat Installation:
   a. Apply "Surface Applied Liquid Bonding Agent" Mix solid over masonry or concrete and fill all pores completely to form bonding, water resistant finish.
   b. Cure: In accordance with Manufacturer’s requirements and ASTM C 932 "Specification for Surface-Applied Bonding Compounds for Exterior Plastering."
6. Brown Coat Installation:
   a. Apply Brown Coat Mix to slightly damp, and cured Scratch Coat.
   b. Finish: Dry rod to a straight even plane.
   c. Float to densify at 1/8 inch in 10 feet and leave rough for finish.
      1) At exterior horizontal soffits with recessed light fixtures, provide a smooth and level brown coat finish around the perimeter of the light fixture housing.
         a) After installation of the brown coat, knock down any ridges and provide a smooth trowel finish within a distance of 3 inches around the light fixture housing. This level of finish is required, so that the light fixture lens (with a compression gasket) can be installed with full contact against the plaster system.
         b) Coordinate with the electrical contractor and obtain a sample fixture lens, and conduct a pre-cement plaster installation meeting to discuss this topic.
   d. Curing: Continuously moist cure a minimum of 48 hours immediately after installation and dry cure a minimum of 7 days, allow time for plaster to shrink prior to application of finish coats.
7. Finish Coat Installation:
   a. Exterior Elastomeric System:
      1) Provide Open Corner Reinforcement where cement plaster is not divided or separated at opening corners. Place diagonally at all corners of openings and apply with cement adhesive on cured Brown Coat.
      2) For application techniques refer to manufacturer's technical bulletins and recommendations. See manufacturer's recommendations for application over existing concrete surfaces.
      3) Level the brown coat surface with primer/base coat.
         a) Primer/base coat shall be applied over the cement plaster brown coat, after the brown coat is cured and before application of the finish color coat.
      4) Finish with manufacturer's finish coat in accordance with manufacturer's recommendations for application, curing times and temperature ranges.
      5) Texture: "WEATHERLASTIC Sandpebble Fine" finish.

3.4 REPAIR / RESTORATION

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.5 FIELD QUALITY CONTROL

A. General: Comply with ASTM C 926 "Standard Specification for Application of Portland Cement-Based Plaster."

1. Do not deviate more than plus or minus 1/8 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Site Tests:
1. As required by Regulatory Requirements.
2. Mock-Up Assemblies:
   a. Water Spray Test: Upon completion of the installation of the Mock-Up Assembly, conduct test for water penetration in according to AAMA 501.2 requirements.
      1) The Project Inspector, the Architect, Contractor's Superintendent and Sub-contactor's Superintendent shall visually inspect for water penetration.
      2) A Thermal Imagining process conducted by the Owner's Testing Laboratory Service, shall be used for additional inspection for water penetration.
      3) Cost of additional testing and inspection required due to failure for water tightness shall be borne by the Contractor.
   b. Reports:
      1) Project Inspector and/or Owner's Testing Laboratory Services shall provide a written report noting the installation and water tightness of the Mock-Up Assemblies tested.

C. Inspection:
1. As required by Regulatory Requirements and in accordance with CBC Section 2503.
2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
3. No work shall be without the inspections required by Regulatory Requirements.

3.6 CLEANING

A. Clean in accordance with Specification Section – PROJECT CLOSEOUT.
1. Clean any soiled surfaces immediately.
2. Finish shall be clean and ready for the application of any additional finishes.
3. In accordance with manufacturer's written instructions and recommendations.

B. Remove temporary protection and enclosure of other work.

C. Promptly remove plaster from door frames, window and other surfaces not indicated to be plastered.

D. Repair floors, walls and other surfaces stained, marred or other wise damaged during plastering

END OF SECTION

SECTION 09 29 00 – GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all gypsum board materials, suspension systems, furring, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 04 22 00 CONCRETE MASONRY UNITS
4. 06 10 00 ROUGH CARPENTRY
5. 06 41 23 MODULAR CASEWORK
6. 07 21 00 INSULATION
7. 07 84 00 FIRESTOPPING
8. 07 92 00 SEALANTS
9. 08 11 00 METAL DOORS AND FRAMES
10. 08 14 16 WOOD DOORS
11. 08 31 13 ACCESS DOORS AND FRAMES
12. 08 33 00 COILING DOORS
13. 09 22 16 METAL FRAMING
14. 09 30 00 TILE
15. 09 50 00 ACOUSTICAL CEILINGS
16. 09 65 10 RESILIENT BASE AND ACCESSORIES
17. 09 65 19 RESILIENT TILE
18. 09 67 23 RESINOUS FLOORING
19. 09 68 40 CARPET
20. 09 72 00 WALL COVERINGS
21. 09 91 00 PAINTING
22. 10 05 00 MISCELLANEOUS SPECIALTIES
23. 10 11 00 VISUAL DISPLAY BOARDS
24. 10 14 00 IDENTIFYING DEVICES
25. 10 26 00 WALL AND CORNER GUARDS
26. 10 28 13 TOILET ACCESSORIES
27. 10 44 00 FIRE PROTECTION SPECIALTIES
28. 11 40 00 FOOD SERVICE EQUIPMENT
29. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:

1. In accordance with the following standards:
   a. CISCA Ceilings & Interior Systems Construction Association.
   b. DITF Drywall Industry Trust Fund.
   c. GA Gypsum Association.
   d. MPI Master Painters Institute
   e. PDCA Painting and Decorating Contractors of America.
   f. PDSM Plaster and Drywall Systems Manual, ©1988 by BNI and McGraw-Hill, Inc., Third Edition.

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product Data.
      a. Gypsum board fastening schedule: Indicate type, size and spacing of fasteners for each type of framing and fire resistive condition.
      b. Manufacturer's written recommended construction instructions or handbook for all gypsum board panel products and accessories.
      c. Manufacturer's written recommended construction instructions or handbook for all suspension system products and accessories
      d. Manufacturer's data for all types of gypsum board used on this project.
   2. Samples.
      a. Provide 24 inch square samples for all textures for each level of finish.
      b. Provide 4 inch lineal samples of each piece of metal trim accessory specified.
      c. Provide 12 inch lineal samples of Suspension System components for each type of system specified.
   3. Quality Assurance/Control Submittals:
      a. Test Reports:
         1) Site Tests of suspended gypsum board ceiling fasteners and anchors provided by Testing Agency.
      b. Certificates:
         1) General Construction: Certificate signed by the Contractor on Contractor's letterhead.
         2) Products: Certificates signed by manufacturers of gypsum board assembly components.
   4. Closeout Submittals in accordance with Specification Section -PROJECT DOCUMENTS.
      a. Warranty in accordance with Specification Section - WARRANTIES.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Material Qualifications:
      a. Where fire-rated gypsum board assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 "Test methods for Fire Tests of Building Construction and Materials," by an independent testing and inspecting agency acceptable to CSFM.
      b. Empty containers shall not be removed from site without the Project Inspector's approval.
   2. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
         1) Helpers and apprentices used for such work shall be under full and constant supervision at all times by thoroughly skilled gypsum board installers.
         2) In the acceptance or rejection of installed gypsum board, no allowance will be made for lack of skill on the part of installers.

B. Regulatory Requirements:
   1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
      a. IR Interpretation of Regulations.

C. Certificates:
   1. General Construction: Contractor to certify that work provided, meets or exceeds the requirements of this section.
   2. Manufacturers of gypsum board assembly components certify that their products comply with specified requirements.

a. Certify that all adhesive and compound materials have a good shelf life longer than the construction period of this project.

D. Mockups:
1. Before starting the finishing of gypsum board surfaces, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and qualities of materials and execution.
a. Install mockups for the following applications:
1) All surfaces without finish texture.
2) All surfaces without finish texture to be painted.
3) All surfaces with finish texture to be painted.
b. Simulate finished lighting conditions for review of mockups.
c. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Meetings:
1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
a. Coordinate the work with other work being performed.
b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
a. Review for proper installation of work progress.
b. Identify any installation problems and acceptable corrective measures.
c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:
1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
2. Damaged products will not be accepted.

C. Storage and protection:
1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.6 WARRANTY

A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
1. In accordance with manufacturer's written standard warranty:
a. Warranty Period One (1) Year.

C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES:
a. Warranty period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified gypsum board products manufacturer:
   a. NATIONAL GYPSUM COMPANY.
      1) Wallboard "REGULAR"
      2) Moisture-Resistant "XP GYPSUM BOARD"
      3) Shaftwall "SHAFTLINER"
      4) Sheathing "eXP SHEATHING"
      5) Soffit "EXTERIOR SOFFIT BOARD"
   b. Acceptable alternative manufacturers:
      1) PABCO:
         a) Wallboard "REGULAR" AND "TYPE X"
         b) Moisture-Resistant "MOLD CURB PLUS"
         c) Shaftwall "MOLD CURB PLUS SHAFLINER"
         d) Sheathing "GLASS SHEATHING"
         e) Soffit "EXTERIOR SOFFIT"
      2) UNITED STATES GYPSUM COMPANY - "SHEETROCK"
         a) Wallboard "SW EDGE"
         b) Moisture-Resistant: "MOLD TOUGH"
         c) Shaftwall "LINER PANEL-MOLD TOUGH"
         d) Sheathing "SECUROCK GLASS-MAT SHEATHING"
         e) Soffit "EXTERIOR GYPSUM CEILING BOARD"
2. Specified Impact and Abuse board products manufacturer:
   a. NATIONAL GYPSUM COMPANY
      1) Impact Board "HI-IMPACT XP"
      2) Abuse Resistant "HI-ABUSE XP"
   b. Acceptable alternative manufacturers:
      1) PABCO.
         a) Impact Board "HI-IMPACT"
         b) Abuse Resistant "ABUSE CURB"
      2) UNITED STATES GYPSUM COMPANY - Walls only.
         a) Impact Board "MOLD TOUGH VHI"
         b) Abuse Resistant "MOLD TOUGH AR"
3. Specified Roof Board board products manufacturer:
   a. G-P GYPSUM "DENS-DECK"
   b. Acceptable alternative manufacturers
      1) UNITED STATES GYPSUM COMPANY
         a) SECUROCK Roof Cover Board.
4. Specified Structural Concrete Panel products manufacturer:
   a. US GYPSUM
5. Specified gypsum board accessories product manufacturer:
   a. Prep. Coat (Drywall Primer):
      1) WESTPAC MATERIALS "PREP COAT"
      2) Acceptable alternative manufacturer:

a) UNITED STATES GYPSUM - SECUROCK First Coat Primer.

b. Primer-Surfacer: "TUFF-HIDE"
1) UNITED STATES GYPSUM COMPANY.

c. Other Accessories:
1) CLARK DIETRICH BUILDING SYSTEMS, LLC (CDBS).

6. Specified revel molding products manufacturer:
a. FRY REGLET CORPORATION.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

1. Shaft Wall Framing: Shaft Wall Steel Framing listed below are manufactured by USG, or approved equivalent.
a. CR-Runners: 2"-width 25 gage.
b. J-Runners: 2-1/2", 4" or 6" as required 20 gage.
c. E-Studs: 2-1/2", 4" or 6" as required 20 gage.
d. C-H Studs: 2-1/2", 4" or 6" as required 20 gage.
e. Jamb Studs: 2-1/2", 4" or 6" as required 20 gage.
f. H-Studs: 2"-width 25 gage.

B. Wallboard: For interior walls and ceilings.
1. Standard: In accordance with ASTM C 1396 "Standard Specification for Gypsum Board."
2. Size: See drawings for specific thickness locations.
a. 5/8 inch thick by 4 foot wide maximum by practical length to minimize joints.
1) When curved walls are indicated on the drawings, provide multiple layers of 1/4 inch & 3/8 inch thick by 4 foot wide maximum by practical length to minimize joints.
3. Long Edges: SW Tapered.
4. Core Type:
a. Non-Fire Rated: Regular.
b. Fire Rated: Type X at fire-resistive-rated assemblies.
5. Finish: Natural-finish face paper suitable for paint, wallpaper or other decorations.

C. Moisture-Resistant: For interior walls subjected to intermittent moisture and humidity and at adhesive application of ceramic tile and wallcoverings.
1. Standard: In accordance with ASTM C 1396 "Standard Specification for Gypsum Board."
a. Surface Burning Characteristics: ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials":
1) Flame Spread: 20.
2) Smoke Developed: 0.
b. Mold/Mildew Characteristics:
1) Mold Resistance: ASTM G 21 "Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi": 0.
2) Mold Resistance: ASTM D 3273 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber": 10.
3) Water Absorption: ASTM C 173 "Test method for Air Content of Freshly Mixed Concrete by the Volumetric Method": less than 5 percent.
2. Size - see drawings for specific thickness locations:
a. 5/8 inch thick by 4 foot wide maximum by practical length to minimize joints.
3. Long Edges: Tapered.
4. Core Type:

a. Non-Fire Rated: Regular moisture-resistant core.
b. Fire Rated: Type X and moisture-resistant additives, at fire-resistive-rated assemblies.

5. Finish: Multi-layered paper facings, chemically treated to resist moisture penetration.

D. Impact Board: For interior walls requiring greater impact resistance.

1. Standard: In accordance with ASTM C 1629 "Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels."
   a. Surface Abrasion Resistance: ASTM D 4977 "Test method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion": Level 3.
   b. Indentation Resistance: ASTM D 5420 "Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a falling Weight (Gardner Impact)": Level 1.
   c. Impact/Penetration Resistance, Soft Body: ASTM E 695 "Standard Method for Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading": Level 3.
   d. Impact/Penetration Resistance, Hard Body: ASTM C 1629 "Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels," Annex 1: Level 3.
2. Mold/Mildew Characteristics:
   a. Mold Resistance: ASTM G 21 "Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi": 0.
   b. Mold Resistance: ASTM D 3273 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber": 10.
   c. Water Absorption: ASTM C 173 "Test method for Air Content of Freshly Mixed Concrete by the Volumetric Method": less than 5 percent.
3. Surface Burning Characteristics: ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials":
   a. Flame Spread: 15.
   b. Smoke Developed: 0.
4. Size: See Drawings for specific thickness locations:
   a. 5/8 inches thick by 4 feet wide maximum by practical length to minimize joints.
5. Long Edges: Tapered.
6. Core Type:
   a. Moisture resistant core with an embedded fiberglass mesh.
   b. Non-Fire-Rated: --
   c. Fire Rated: Type X at fire-resistive-rated assemblies.
7. Finish: Abrasion and mold/mildew/moisture resistant paper on the face side, and abrasion and mold/mildew/moisture resistant paper on the back side.

E. Abuse Resistant: For interior walls and ceilings requiring greater impact resistance.

1. Standard: In accordance with ASTM C 1629 "Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels."
   a. Surface Abrasion Resistance: ASTM D 4977 "Test method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion": Level 3.
   b. Indentation Resistance: ASTM D 5420 "Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a falling Weight (Gardner Impact)": Level 1.
   c. Impact/Penetration Resistance, Soft Body: ASTM E 695 "Standard Method for Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading": Level 1-2.
2. Mold/Mildew Characteristics:
   a. Mold Resistance: ASTM G 21 "Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi": 0.

b. Mold Resistance: ASTM D 3273 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber": 10.
c. Water Absorption: ASTM C 173 "Standard Test Methods for Physical Testing of Gypsum Panel Products": less than 5 percent.

3. Surface Burning Characteristics: ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials":
   a. Flame Spread: 15.
   b. Smoke Developed: 0.
4. Size: See Drawings for specific thickness locations:
   a. 5/8 inches thick by 4 feet wide maximum by practical length to minimize joints.
5. Long Edges: Tapered.
6. Core Type:
   a. Moisture resistant core.
   b. Non-Fire-Rated: --
   c. Fire Rated: Type X at fire-resistive-rated assemblies.
7. Finish: Abrasion and mold/mildew/moisture resistant paper on the face side, and abrasion and mold/mildew/moisture resistant paper on the back side.

F. Shaftwall: For interior walls and ceiling at shafts, area separations, high-attenuation, floor/ceiling assemblies, etc.
1. Standard: ASTM C 1396 "Standard Specification for Gypsum Board."
2. Size: 1 inch thick by 2 foot wide maximum by practical length to minimize joints.
3. Long Edges: Beveled.
4. Core Type: Type X at fire-resistive-rated assemblies.
5. Finish: Multi-layered paper facings, chemically treated to resist moisture penetration.

G. Sheathing/Soffit: For exterior walls and soffits.
1. Standard: ASTM C 1177 "Standard Specification for Glass-Mat Gypsum Substrate for use as Sheathing."
   a. Surface Burning Characteristics per ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials":
      1) Flame Spread: 20.
      2) Smoke Developed: 0.
2. Long Edges: Square.
3. Type and Thickness: [Regular, 1/2 inch] [Type X, 5/8 inch] thick.
4. Facing: fiberglass mat laminated to both sides.

H. Roof Board:
1. Thickness 5/8 inch.
2. Surfacing: Glass Mat.
3. Flute Spanibility:
   a. 5/8 inch thick: 8 inches per ASTM E 661 "Test Method for Performance of Wood and Wood-Based Floor and Roof Sheathing Under Concentrated Static and Impact Loads."
4. "R" Value:
   a. 5/8 inch thick: 0.67 per ASTM C 518 "Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus."
5. Water Absorption: 10.0
   a. Per ASTM C 473 "Test methods for Physical Testing of Gypsum Panels and Products."
6. Compression Strength: 500-900 psi normal.
7. Surface Water Absorption: 2.5 grams.
   a. Nominal per ASTM C 473 "Test methods for Physical Testing of Gypsum Panels and Products."
8. Flame Spread / Smoke Developed Index: 0/0.

a. Per ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials."

9. Mold Resistance: No Growth.
   a. Per ASTM D 3273 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber."

I. Structural Concrete Panel: For non-combustible structural subfloor.
   1. Standard: High Strength reinforced concrete panels in accordance with ASTM C 1185 "Standard Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards", ICC-ES AC 318 and ICC-ES AC 319.
      a. Moment Capacity: 1585 lb-in/ft. .
      b. Bending Stiffness: 315,000 lb-in^2/ft.
      c. Density: 75 lb/ft^3.
      d. Weight: 50 lbs/ft^2 tested in accordance with ASTM D 1037 at a thickness of 3/4 inch.
      e. Non-combustibility: Pass tests in accordance to ASTM E 136-12. .
   2. Mold/Mildew Characteristics:
      a. Mold Resistance: ASTM G 21 "Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi": 0.
      b. Mold Resistance: ASTM D 3273 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber": 10.
      c. Water Absorption: ASTM C 1185 "Standard Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards": less than 15 percent.
   3. Surface Burning Characteristics: ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials":
      a. Flame Spread: 0.
      b. Smoke Developed: 0.
   4. Size:
      a. 3/4 inches thick by 4 feet wide maximum by practical length to minimize joints.
   5. Edges: Tongue and Groove.

J. Metal Accessories:
   1. Corner Beads:
      a. Outside Corner, 1-1/4 inch x 1-1/4 inch galvanized:
         1) CDBS / USG "Dur-A-Bead" #103.
   2. Edge Trim:
      a. "U"-Shaped 1 inch galvanized CDBS / USG #200-A, size to fit gypsum board.
      b. "L"-Shaped 1 inch galvanized CDBS / USG #200-B, size to fit gypsum board.
         1) When "U"-Shaped molding above cannot be used.
   3. Control Joint:
      a. 1-3/4" wide, 1/4" wide center channel with removable tape strip:
         1) CDBS / USG #093.
   4. Reveal Moldings (Aluminum Trim): Moldings listed below are manufactured by FRY REGLETS, or approved equivalent.
      a. Reveal Molding Sized to fit gypsum board.
      b. "L" Trim Molding Sized to fit gypsum board.
      c. "F" Reveal Molding Sized to fit gypsum board.
      d. Snap-In Reveal Sized to fit gypsum board.
      e. "Z" Reveal Molding Sized to fit gypsum board.
      f. Reveal Channel Screed Sized to fit gypsum board.
      g. "F" Reveal Sized to fit gypsum board.
      h. "T" Molding Sized to fit gypsum board.

2.3 ACCESSORIES

A. Water:
   1. Clean, fresh and free from deleterious amounts of foreign material.

B. Fasteners:
   1. At Gypsum Board: In accordance with the manufacturer's written recommendations and the following:
      a. Nails: In accordance with CBC Chapter 7 and ASTM C 514 "Standard Specification for Nails for the Application of Gypsum Board."
      b. Screws: In accordance with CBC Chapter 7, ASTM C 1002 "Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs," type S, G, and W, and ASTM C 954 "Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness," Type S-12.
         1) Provide "Bugle Head" screws that help prevent damage to the gypsum core and face paper.
      c. Adhesives: In accordance with ASTM C 475 "Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board."
         1) Commercial adhesives bridging minor irregularities in the base or framing at "non-fire-rated" construction.
            a) In accordance with ASTM C 557 "Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing."

C. Joint reinforcement tape and joint compounds:
   1. In accordance with ASTM C 474 "Standard Test Methods for Joint Treatment Materials for Gypsum Board Construction" and C 475 "Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board," and Gypsum Board Manufacturer's written recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.
      a. Joint Tapes:
         1) Paper reinforcing tape, unless otherwise indicated.
         2) Polymer-coated, open glass-fiber mesh for cementitious backer units.
      b. Setting-Type Joint compounds for gypsum board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
         1) When used for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
         2) When used for pre-filling gypsum board joints, use formulation recommended by gypsum board manufacturer for this purpose.
         3) When used for filling joints and treating fasteners of moisture-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by the gypsum board manufacturer for this purpose.
         4) When used for topping compound, use sandable formulation.

D. Prep. Coat: Provide a preparation coat of the specified material to gypsum board surfaces to be decorated with all paints.

E. Primer-Surfacer: "TUFF-HIDE" by USG, Interior White Latex High Build Spray for a smoother paint finish over all types of drywall, 9.8 to 13 mils DFT in one spray application

F. Textured Finish Coats: Gypsum Board manufacturer supplying the products to this project shall also supply the Texture Finishes to provide distinctive appearance and surface decoration to gypsum board panel walls and ceilings, and as scheduled at the end of this Specification Section.

G. Other Materials: All other miscellaneous materials, not specifically described, but required for a complete and proper installation of gypsum board, shall be as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
   1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
   2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
   3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
   2. Coordinate proper placement of ceiling mounted tracks, accessories, light fixtures, HVAC, registers and other items, which are to be integrated with gypsum board ceilings.

B. Protection:
   1. Do not begin work until all rooms have been protected against the weather, and the building is covered and fully enclosed. Wet gypsum board after installation shall be removed and replaced at no extra cost to the Owner.
   2. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

C. Surface preparation:
   1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
   2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

3.3 INSTALLATION

A. General:
   1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
   2. In accordance with Regulatory Requirements.
      a. DSA's IR 25-3 "Suspended Gypsum Board Ceiling."
   3. Set plumb, level, and square.

B. Layout:
   1. Lines shall be straight and true.
   2. Control Joints:
      a. Layout in accordance with GA-234-08 for both Non-Rated and Rated wall and ceiling conditions as follows:
         1) Provide Control Joints at in an uninterupted straight plane exceeding 30 ft. in length and total area between control joints, such that no area exceeds 900 sq.ft.

C. Gypsum Board:
   1. General:
      a. During Winter Weather Installation periods, follow the GA-220 GYPSUM BOARD WINTER RELATED INSTALLATION RECOMMENDATIONS.
   2. Install in accordance with CBC Chapter 25, DITF and GA recommendations, gypsum board panel manufacturer's written recommendations and in accordance with fire-rated design numbers.

a. At Ceilings and Soffits:
   1) At gypsum board ceilings and soffit areas, install the ceiling prior to installing the walls.
   2) Float the interior ceiling angles, and where permitted by code,
b. At Sound and Acoustical Walls:
   1) Set all gypsum board panels on each side of the partition in a continuous 1/4 inch bead of acoustical sealant furnished and installed in accordance with the provisions of Specification Section -- SEALANTS.
c. At Moisture Resistant Walls:
   1) Install where scheduled and in all areas where high moisture conditions are present, or ceramic tile, or wall coverings are scheduled over gypsum board.
   2) In all areas to be tiled, treat all edges, cutouts, utility holes and joints, corners and nailheads with an approved sealant material in lieu of standard taping. Joints not to be covered by tile shall be treated as regular gypsum board. Do not use standard joint compound under ceramic tile.
d. At Sheathing:
   1) Screw-attach sheathing to exterior of each stud with 1" Type "S-12" corrosion resistant screws spaced 3/8" from ends and edges and approximately 8" o.c. Apply sealant around sheathing perimeter at interface with other materials and install flashing.

3. Install gypsum board panels horizontally on walls, floor to ceiling.
4. At metal frames terminate wall board panel edge inside frame. Do not terminate gypsum board panel edge against metal frame trim unless otherwise indicated.

D. Structural Concrete Panel Subfloor Application:
1. Structural Concrete Panel Subfloor shall be installed in a horizontal manner (long edges perpendicular to the framing). Second layer shall be installed perpendicular to first layer.
2. The fire, sound and structural ratings of the Structural Concrete Panel Subfloor system are based on mechanical attachment only.
3. Cutouts in the panels shall be made before installing the panel whenever possible. If a cutout is required after the panel is installed, set the depth of the saw blade to ensure that the framing is not scored. Support the ends and edges of cutouts with framing if they are larger than 6" in either direction.
4. Ensure panel is flush with supporting member, drive fasteners so the heads are flush with the surface of the board.
5. During Construction Traffic Protection: Prior to floor finishing, place sheathing materials on the floor in high traffic areas to newly installed Structural Concrete Panel Subfloor.

E. Cutting:
1. Cut gypsum board panels by scoring and breaking or by sawing, working from the face side.
   a. When cutting by scoring, cut through the face paper and then snap the panel back away from the cut face; then break the backpaper by snapping the panel in the reverse direction or by cutting the back paper.
2. Smooth all cut ends and edges of panels as necessary to obtain a smooth joint.
3. For cut-outs in panels for pipes, fixtures, and other small openings, make holes and cut-outs by sawing or by such other method as will not fracture the core or tear the covering and with such accuracy that plates, escutcheons, or trim will cover the edges.
4. The use of "score-and-knockout" method will not be permitted.

F. Metal Accessories:
1. Corner Beads:
   a. Install at all corners with galvanized screws at nine (9) inch intervals in both flanges with fasteners placed opposite one another the full length of the corner bead. Clinch-on fastening is not allowed.

1) Fasteners shall be driven below the anticipated finished joint compound surface.

b. Install in one piece except when length of corner exceeds stock lengths – then put splice up high away from people traffic.

2. Edge Trim: Install at all exposed joints where gypsum board panels abut another material with galvanized screws at nine (9) inch intervals the full length of the edge trim. Clinch-on fastening is not allowed.
   a. Fasteners shall be driven below the anticipated finished joint compound surface.
   b. Provide joint sealer in accordance with Specification Section -- SEALANTS.
      1) Provide fire sealant in accordance with Specification Section -- FIRSTOPPING or Specification Section -- SEALANTS, when the wall or ceiling is part of a fire-rated situation.
3. Control Joints:
   a. Install at 30'-0" o.c. maximum at all interior walls or partitions with uninterrupted planes that exceed 30' in length.
      1) Opening frames that are full height of wall or partition may be considered a control joint.
   b. Install at 50'-0" o.c. maximum at all interior ceilings and shall not exceed 2,500 sq.ft. in total area with perimeter relief.
   c. Install at 30'-0" o.c. maximum at all interior ceilings and shall not exceed 900 sq.ft. in total area without perimeter relief.

G. Fastening:
1. Properly space all fasteners in careful accordance with the manufacturer's written recommendations and code requirements, with heads driven slightly below the surface for proper cementing, but without breaking the paper face.
2. Loosely butt all joints to be taped; firmly butt all joints to be left untreated.
3. Stagger all end joints and the joints between panels to achieve a maximum of bridging and a minimum of continued joints.

H. Taping and Finishing:
1. First Coat:
   a. Spread compound evenly over all joints, using suitable tools designed for the purpose.
   b. Fill all joint recesses and metal trim.
   c. Center the reinforcing tape on the joint and press into the fresh compound at all joints, wiping down with sufficient pressure to remove excess compound but leaving sufficient compound under the tape for proper bond.
   d. Feather all edges and leave the surface free from blisters and tape wrinkles.
   e. Apply compound to all fastener recesses, leaving flush with the adjacent surfaces.
   f. Fold reinforcing tape along its centerline and apply to all interior angles, following the same procedure as for joints.
   g. Surfaces shall be free of excess joint compound.
2. Second Coat:
   a. Lightly sand the dry compound with fine sandpaper to remove all irregularities.
   b. Apply a second coat of compound to all joints, feathering approximately three inches beyond edges of tape.
   c. Apply second coat to all fastener recesses.
   d. Surfaces shall be free of excess joint compound.
3. Third Coat:
   a. Lightly sand the dry compound with fine sandpaper to remove irregularities.
   b. Apply final skim coat, feathering out approximately two inches beyond second coat.
   c. Third coat all fastener recesses and metal trim, and all interior angles; allow to dry.
   d. Surfaces shall be free of excess joint compound.

I. Prep. Coat (Drywall Primer):

1. Apply Prep. Coat material at approximately 200 sq.ft. per gallon for all painted wall surfaces. Follow manufacturer's written recommendations for proper preparation of material, mixing and installation at recommended minimum coverage rates.
    a. For smooth walls with no texture, provide airless sprayer application in accordance with manufacturer's written recommendations.
        1) Fine finish: Sand wall surface with 220 grit mesh screen after application of Prep. Coat. **Do not oversand!**
    b. For textured walls: Provide roller application with a 3/8" to 1/2" nap roller before texture application is applied in accordance with manufacturer's written recommendations.

J. Primer - Surfacer:
1. Apply Primer - Surfacer material at manufacturer's written recommendations for proper preparation of material, mixing and installation, and at recommended minimum coverage rates.
    a. For smooth walls with no texture, provide airless sprayer application in accordance with manufacturer's written recommendations.
        1) Fine finish: Sand wall surface with 220 grit mesh screen after application of Primer - Surfacer. **Do not oversand!**
    b. For textured walls: Provide roller application with a 3/8" to 1/2" nap roller before texture application is applied in accordance with manufacturer's written recommendations.

K. Textured Finish Coats: After taping and finishing, apply Textured Finish Coats as indicated in the schedule at the end of this Specification Section.

3.4 FIELD QUALITY CONTROL

A. Marking and Identification:
1. Where there is an accessible concealed floor, floor-ceiling or attic space, fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling in the concealed space and shall comply with all of the following:
    a. Be located in accessible concealed floor, floor/ceiling, or attic spaces.
    b. Be located within 15 feet of the end of each wall and at intervals not exceeding 30 feet measured horizontally along the wall or partition.
    c. Include lettering not less than 3 inches in height with a minimum 3/8 inch stroke in a contrasting color identifying the wall type and its fire-resistance rating.
        1) "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS," or other wording.

B. Inspection:
1. As required by Regulatory Requirements.
2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
3. No work shall be without the inspections required by Regulatory Requirements.

3.5 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
1. Clean any soiled surfaces immediately.
2. Clean any soiled surfaces at the end of each day, minimum.
3. Finish shall be clean and ready for the application of any additional finishes.
4. In accordance with manufacturer's written instructions and recommendations.

3.6 PROTECTION

A. Protection from weather:

1. Protect newly installed work from moisture after installation.

B. Protection from traffic:

1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

3.7 SCHEDULES

A. The following textured finish coat finishes shall be applied to the board surfaces within the scope of this section prior to covering with other finish materials.

1. Refer to the Material and Finish Schedule for specific locations of each substrate finish.
2. Where no specific substrate finish is called for on the drawings, select the appropriate level of substrate finish from the descriptions below for the final finish material.
3. Where no determination can be made from the descriptions below, provide a minimum of GB-2 substrate finish.
4. Where sound, smoke control or fire-ratings are required, details of construction shall be in accordance with reports of tested assemblies meeting the requirements.

B. GB-1 - Architect's Finish Designation:

1. Level 5 - GYPSUM ASSOCIATION'S LEVEL OF GYPSUM BOARD FINISH:
   a. All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat of joint compound or a material manufactured especially for this purpose, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.
   b. Architect's Finish:
      1) Uniformly smooth and ready to receive Large Format Tiles, light grade wallcoverings, or fine textured finishes, or flat, semi-gloss, or gloss paints over flat surfaces.
      2) Use "Fog and Splatter" fine textured finish where walls and ceilings are scheduled to be painted, unless otherwise noted.

C. GB-2 - Architect's Finish Designation:

1. Level 4 - GYPSUM ASSOCIATION'S LEVEL OF GYSPSUM BOARD FINISH:
   a. All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound surfaces shall be smooth and free of tool marks and ridges.
   b. Architect's Finish:
      1) Uniformly smooth and ready to receive light textures ("Spray-Splatter," "Orange Peel" (light or heavy) "Stipple" or "Skip Trowel" finishes), or medium grade wall-coverings.
      2) Use "Orange Peel" light texture finish when walls and ceilings are scheduled to be painted, unless otherwise noted.

D. GB-3 - Architect's Finish Designation:

1. Level 2 - GYPSUM ASSOCIATION'S LEVEL OF GYSPSUM BOARD FINISH:
   a. All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
   b. Architect's Finish:

1) Total surface must be sufficiently smooth to create a good bonding plane acceptable for installation of scheduled materials (ceramic tile, plywood, acoustical tile or similar materials).

E. GB-4 - Architect's Finish Designation:
1. Level 3 - GYPSUM ASSOCIATION'S LEVEL OF GYSPSUM BOARD FINISH:
a. All joints and interior angles shall have tape embedded in joint compound and one additional coat of joint compound applied over all joints and interior angles. Fastener heads and accessories shall be covered with two separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges.
b. Architect's Finish:
1) Uniformly smooth and ready to receive heavy grade wallcoverings or medium heavy texture finishes (spray or hand applied).
2) Use medium textured finishes where walls and ceilings are scheduled to be painted, unless otherwise noted.

F. GB-5 - Architect's Finish Designation:
1. Level 1 - GYPSUM ASSOCIATION'S LEVEL OF GYSPSUM BOARD FINISH:
a. All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
b. Architect's Finish:
1) No applied texture. Use at areas that are above finished ceilings, in attics, in areas where the assembly would generally be concealed.

G. GB-6 - Architect's Finish Designation:
1. Level 0 - GYPSUM ASSOCIATION'S LEVEL OF GYSPSUM BOARD FINISH:
a. No taping, finishing, or accessories required.
b. Architect's Finish:
2. Intended for "Temporary Partitions" and not for permanent construction. Not suitable for Fire-resistive construction.

END OF SECTION

SECTION 09 30 00 - TILE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all tile materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 30 00 CAST-IN-PLACE CONCRETE
4. 04 22 00 CONCRETE MASONRY UNITS
5. 06 10 00 ROUGH CARPENTRY
6. 07 18 50 VAPOR-ALKALINITY CONTROL
7. 07 92 00 SEALANTS
8. 08 31 13 ACCESS DOORS AND FRAMES
9. 09 22 16 METAL FRAMING
10. 09 24 00 CEMENT PLASTER
11. 09 29 00 GYPSUM BOARD
12. 10 28 13 TOILET ACCESSORIES
13. 11 40 00 FOOD SERVICE EQUIPMENT
14. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:

1. In accordance with the following standards:
   a. ADAAG Americans with Disabilities Act Accessibilities Guidelines
   b. ADAS Americans with Disabilities Act Standards
   c. ANSI American National Standards Institute, Specifications for the Installation of Ceramic Tile, latest edition, unless otherwise indicated.
   d. FDA Food and Drug Administration
   e. TCNA Tile Council of North America "Handbook for Ceramic Tile Installation"

1.3 DEFINITIONS

A. Definitions shall comply with the latest edition of the TCNA "Handbook for Ceramic Tile Installation."

1. MOH's: Relative Measure of Hardness by scratching the surface of the tile with different minerals and subjectively assigning a "MOH's Scale Hardness" number to the glaze.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Product Data:
   a. For each type of Tile indicated.
   b. Manufacturer's full color range (including any standard and premium colors).
   c. Design Data for components, fillers, adhesives, etc.
2. Shop Drawings:

a. Location of all movement/expansion joints.

3. Samples:
   a. 12 inch square sample of each color and pattern selected.
   b. 6 inch lineal samples of each piece of trim material specified.
4. Quality Assurance/Control Submittals:
   a. Test Reports:
      1) From Manufacturer that all floor tile complies with the slip resistance standards recommended by the ADAAG/ADAS.
   b. Certificates:
      1) Provide TCNA Master Grade Certificate.
   c. Manufacturer's Written Installation Instructions.
   d. Statement of Installer's Qualifications.
5. Closeout Submittals in accordance with the following:
   a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
   b. Warranty in accordance with this specification, and with Specification Section - WARRANTIES.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Material Qualifications:
      a. Tile Grade: Standard Grade in accordance with ANSI A 137.1x.
      b. Tile shall meet the Breaking Strength limits listed in accordance with ASTM C 648 "Test Method for Breaking Strength of Ceramic Tile."
      c. Tile shall meet the Scratch Hardness limits in accordance with MOH's
      d. TCNA Master Grade Certificate signed by tile manufacturer and tile installer.
   2. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.

B. In accordance with Specification Section - REGULATORY REQUIREMENTS.
   a. CBC California Building Code (CBC 804.1)

C. Meetings:
   1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
      a. Coordinate the work with other work being performed.
      b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
      c. Review delivery, storage, and handling procedures.
      d. Review Project Conditions.
      e. Review subfloor preparation procedures.
   2. Progress: Scheduled by the Contractor during the performance of the work.
      a. Review for proper installation of work progress.
      b. Identify any installation problems and acceptable corrective measures.
      c. Identify any measures to maintain or regain project schedule if necessary.
   3. Completion: Scheduled by the Contractor upon proper completion of the work.
      a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
      b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
   1. Products shall be handled in such a manner as to assure that they are free from dents, chips, scratches and other damage.

B. Acceptance at Site:
   1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
   2. Damaged products will not be accepted.
C. Storage and protection:
   1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
      a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.7 PROJECT CONDITIONS
A. Environmental requirements:
   1. Temperature:
      a. Maintain temperature in space to receive ceramic tile above 50 degrees F for 3 days prior, during, and 7 days following installation.
B. Existing Conditions:
   1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
   2. Field Measurements:
      a. Take and be responsible for field measurements as required.
      b. Report any significant differences between field dimensions and drawings to the Architect.

1.8 WARRANTY
A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.
B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written standard warranty,
   2. Warranty Period shall be for the following:
      a. Interior Ceramic/Porcelain Tile One (1) Year.
      b. Exterior Ceramic/Porcelain Tile One (1) Year.
C. Installer's Warranty:
   1. In accordance with the terms of the Specification Section - WARRANTIES:
      a. Warranty period: One (1) Year.

1.9 MAINTENANCE
A. Extra Materials:
   1. Maintenance Material:
      a. In accordance with Specification Section - PROJECT CLOSEOUT.
      b. Supply 2 square feet of tile and 3 lineal feet of trim for each color and pattern of tile

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Interior Ceramic Tile manufacturer:
   a. DALTILE.
   b. Acceptable alternative manufacturers:
      1) CROSSVILLE CERAMICS.
      2) INTERCERAMIC.
2. Grout Materials manufacturer:
   a. MAPEI.
   b. Acceptable alternative manufacturers:
      1) CUSTOM BUILDING PRODUCTS, INC.
      2) LATICRETE.
3. Mortar Materials manufacturer:
   a. MAPEI.
   b. Acceptable alternative manufacturers:
      1) CUSTOM BUILDING PRODUCTS, INC.
      2) LATICRETE.
4. Admixture manufacturer:
   a. MAPEI "Plancrete AC."
5. Metal Trim manufacturer:
   a. SCHLUTER SYSTEMS.
6. Membranes manufacturer:
   a. THE NOBLE COMPANY.
   b. Acceptable alternative manufacturers:
      1) DALTILE.
      2) INTERCERAMIC.
7. Cementitious Backer Units manufacturer:
   a. USG CORPORATION "DUROCK Cement Board"
   b. Acceptable alternative manufacturers:
      1) C-CURE "C-Cure Board 990"
      2) CUSTOM BUILDING PRODUCTS "Wonderboard"
      3) FINPAN, INC. "Util-A-Crete Concrete Backer Board"
8. Sealer manufacturer:
   a. CUSTOM BUILDING PRODUCTS Tile Lab "Surface Gard Penetrating Sealer"
      1) Acceptable alternative manufacturers:
         a) C-CURE "Penetrating Sealer #978"

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. General:
1. Slip Resistance:
   a. Level Surfaces:

1) Static Coefficient of Friction (SCOF): Tile installed on level walkway surfaces shall be slip resistant by achieving a minimum 0.6 or greater static coefficient of friction as recommended in Appendix A4.5 of the ADAAG by testing per ASTM C 1028 "Test method for Static Coefficient of Friction of Ceramic Tile and Like Surfaces by the Horizontal Dynometer Pull Meter Method."
2) Dynamic Coefficient of Friction (DCOF): Tile installed on level walkway surfaces shall be slip resistant by achieving a minimum 0.42 or greater dynamic coefficient of friction as recommended in ADAS per TCNA technical bulletin "Coefficient of Friction and the DCOF AcuTest," by testing per ANSI A 137.1 "American National Standard Specifications for Ceramic Tile," section 9.6 "Procedure for Dynamic Coefficient of Friction (DCOF) Testing."

b. Ramps:
1) Tile installed on ramps shall achieve a minimum 0.8 or greater static coefficient of friction as recommended in Appendix A4.5 of the ADAAG by testing per ASTM C 1028 "Test method for Static Coefficient of Friction of Ceramic Tile and Like Surfaces by the Horizontal Dynometer Pull Meter Method."

2. Colors and patterns shall be selected from manufacturer's standard line (including premium), except as noted otherwise.

B. Ceramic:
1. Interior Floor Tile **CT-1.**
a. Manufacturer: DALTILE.
1) "Keystones" unglazed mosaics, Group 2.
2) Trim to match.
a) Tile Trim Units: Provide tile trim units (i.e. "bullnoses," "thin-set bullnoses," "coves," "thin-lip bases," "round top bases," "beads," and "countertop edge trims" as is appropriate to tile types) to match characteristics of adjoining flat tile.
b. Design: 2" x 2" x 1/4" thick.
c. Pattern: Any combination thereof of the sizes listed above, to be back/edge mounted on manufacturers strong, flexible 2' x 1' sheets.
d. Grout joint width: 1/8".
e. Color: Refer to Interior Color Schedule
f. Material: Unglazed Porcelain Ceramic Mosaics.
1) Water Absorption: less than 0.5 percent.
2) Breaking Strength: greater than 364 lbs.
3) Chemical Resistance: Resistant.
4) Bond Strength: greater than 65 psi.
5) Coefficient of Friction: greater than or equal to 0.60.
g. Base:
1) 6" high x 12" long x 2" x 2" back/edge mounted built-up coved base, including inside and outside corner trims.
2) Pattern to match floor tile.
2. Interior Floor Tile **CT-2.**
a. Manufacturer: DALTILE
1) “Ironcraft” Colorbody Porcelain
2) Trim to match.
a) Tile Trim Units” Provide tile trim units (i.e. “bullnoses”, “thin-set bullnoses”, “coves”, “thin-lip bases”, “round top bases”, “beads”, and “countertop edge trims” as is appropriate to tile types) to match characteristics of adjoining flat tile.
b. Design: 2” x 2” x 3/8” thick.

c. Pattern: Single Size Tile Pattern
d. Grout Joint width: 3/16”
e. Color: Refer to interior color schedule.
f. Material: Colorbody Porcelain with Reveal Imaging.
   1) Water Absorption: less than 0.5 percent
   2) Scratch Hardness: 8.0.
   3) Chemical Resistance: Resistant
g. Base:
   1) 6” x 12” coved based including inside and outside corner trims.
   2) Pattern to match wall tile.

3. Interior Wall Tile: **CT-3.**
   a. Manufacturer: DALTILE.
      1) Color Wheel Classics Collection, Groups 1 =.
      2) Trim to match.
         a) Tile Trim Units: Provide tile trim units (i.e. "bullnoses", "thin-set bullnoses," "coves," "thin-lip bases," "round top bases," "beads," and "countertop edge trims" as is appropriate to tile types) to match characteristics of adjoining flat tile.
   b. Design: 4-1/4" x 4-1/4" x 5/16" thick.
   c. Pattern: Single size tile pattern.
   d. Grout joint width: 1/16".
   e. Color: Refer to Interior Color Schedule
   f. Material: Interior Glazed Ceramic.
      1) Water Absorption: less than 16.0 percent.
      2) Scratch Hardness: 4.
      3) Chemical Resistance: Resistant.

4. Interior Wall Tile: **CT-4.**
   a. Manufacturer: DALTILE.
      1) Color Wheel Classics Collection, Group 3.
      2) Trim to match.
         a) Tile Trim Units: Provide tile trim units (i.e. "bullnoses", "thin-set bullnoses," "coves," "thin-lip bases," "round top bases," "beads," and "countertop edge trims" as is appropriate to tile types) to match characteristics of adjoining flat tile.
   b. Design: 4-1/4" x 4-1/4" x 5/16" thick.
   c. Pattern: Single size tile pattern.
   d. Grout joint width: 1/16".
   e. Color: Refer to Interior Color Schedule.
   f. Material: Interior Glazed Ceramic.
      1) Water Absorption: less than 16.0 percent.
      2) Scratch Hardness: 4.
   g. Chemical Resistance: Resistant

5. Interior Wall Tile: **CT-5.**
   a. Manufacturer: DALTILE.
      1) Color Wheel Classics Collection, Groups 1
      2) Trim to match.
         a) Tile Trim Units: Provide tile trim units (i.e. "bullnoses", "thin-set bullnoses," "coves," "thin-lip bases," "round top bases," "beads," and "countertop edge trims" as is appropriate to tile types) to match characteristics of adjoining flat tile.
   b. Design: 3” x 6” x 5/16” thick.
   c. Pattern: Staggered Brick Joint pattern, refer to interior elevations.
   d. Grout joint width: 1/16".

e. Color: Refer to Interior Color Schedule.
f. Material: Interior Glazed Ceramic.
1) Water Absorption: less than 16.0 percent.
2) Scratch Hardness: 4.
g. Chemical Resistance: Resistant

6. Interior Wall Tile: **CT-6.**
a. Manufacturer: DALTILE.
1) Color Wheel Linear Collection, Groups 1
2) Trim to match.
a) Tile Trim Units: Provide tile trim units (i.e. "bullnoses", "thin-set bullnoses," "coves," "thin-lip bases," "round top bases," "beads," and "countertop edge trims" as is appropriate to tile types) to match characteristics of adjoining flat tile.
b. Design: 4” x 12” x 5/16” thick.
c. Pattern: Staggered Brick Joint Pattern, Refer to interior elevations.
d. Grout joint width: 1/16".
e. Color: Refer to Interior Color Schedule.
f. Material: Interior Glazed Ceramic.
1) Water Absorption: less than 16.0 percent.
2) Scratch Hardness: 4.
g. Chemical Resistance: Resistant
h. Base:
1) 4” x 12” Flat top coved base including inside and outside corners
2) Pattern to match wall tile

7. Interior “Accent” Wall Tile: **CT-7.**
a. Manufacturer: DALTILE
1) Color Wheel Retro, Group 3
2) Trim
a) Tile trim Units: SCHLUTER “Jolly” for inside, outside and edge trim pieces as necessary for a complete installation
b) Size: 6mm
c) Profile: J 60 EB
d) Color: Brushed Stainless Steel
b. Design: 2 x 3 Cube Mosaic x ¼” thick
c. Pattern: Single size tile pattern
d. Grout joint width: 1/8”
e. Color: Refer to Interior Color Schedule.
f. Material: Interior Glazed Ceramic
1) Water absorption: less than 3 percent.
2) Scratch Hardness: 4.0-6.0
3) Chemical Resistance: Resistant

8. Interior Wall Tile: **CT-8**
a. Manufacturer: DALTILE
1) Slimlite Porcelain Panels
2) Trim: Schluter "Schiene” 1/8” in the color matte black
b. Design: 20” x 39” x 1/8” thick
a) Grout 1/16”
c. Pattern: Staggered Brick Joint Pattern. Refer to Interior Elevations
d. Color: Refer to Interior Color Schedule
e. Material: Glazed Porcelain
1) Water Absorption: Less than 0.5 percent
2) Scratch Hardness: 7.0
f. Chemical Resistance: Resistant
g. Mortar: Large-format tile mortar

C. Setting Bed:
1. Thick-Set:
a. Portland Cement: In accordance with ASTM C 150 "Specification for Portland Cement," Type 1.
b. Sand (Aggregate): In accordance with ASTM C 144 "Standard Specification for Aggregate for Masonry Mortar."
c. Hydrated Lime: In accordance with ASTM C 207 "Specification for Hydrated Lime for Masonry Purposes.," Type S.
d. Admixture: Shall be Mortar Latex Admix "Planicrete AC" as manufactured by MAPEI, or approved equivalent.
1) This Admixture serves as a replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
2. Medium Bed/Modified Dry-Set Cement Mortar: In accordance A118.15 HET and A118.11. 3/4" maximum thickness.
a. Shall be "Large Floor Tile Mortar" by MAPEI, or approved equivalent.
1) Approved Equivalent: 'ProLite Premium Large Format Tile Mortar' by CUSTOM BUILDING PRODUCTS.
b. For floor applications in which the long edge of tile exceeds 8" (large format tiles).
3. Thin-Set:
a. Dry-Set Portland Cement Mortar: In accordance with ANSI A 118.1-1999.
1) Shall be "Kerabond" by MAPEI, or approved equivalent for floor and wall surfaces.
a) For wall applications, provide non-sagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.
b. Modified Dry-Set Cement Mortar: In accordance with A118.15 HET and A118.11.
1) Shall be "Large Floor Tile Mortar" by MAPEI, or approved equivalent.
a) Approved Equivalent: 'ProLite Premium Large Format Tile Mortar' by CUSTOM BUILDING PRODUCTS.
2) For floor applications in which the long edge of tile exceeds 8" (large format tiles).
c. Latex-Portland Cement Mortar: In accordance with ANSI A 118.4-1999.
1) Shall be "Keralastic" + "Kerabond" by MAPEI, or approved equivalent for floor and wall masonry or floor and wall concrete surfaces.
a) For wall applications, provide non-sagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.

D. Grout:
1. Cement:
a. ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
2. Commercial Cement:
a. ANSI A118.6, composed of Standard Sanded Cement Grout, color as indicated.
3. Silicone-Rubber:
a. One-part, chemically curing, silicone-rubber-based elastomeric sealants used for factory-grouted joints within pre-grouted sheets of glazed wall tile and for field-grouted joints between the same pre-grouted sheet
1) Silicone-Rubber grout shall not be used on kitchen countertops or other food preparation surfaces unless it meets the requirements of FDA Regulation No. 21, CFE 177.2600.
4. Dry-Set:
a. ANSI A 108.5-1999 and ANSI A 118.1-1999, a mixture of Portland Cement with sand and additives, color as indicated.

5. Epoxy:
    a. ANSI A118.3-1999, Chemical-Resistant, Water-Cleanable, Ceramic Tile-Setting and Grouting Epoxy, color as indicated.

2.3 ACCESSORIES

A. Metal Trim:
1. Outside Wall Corner and Edges:
    a. Manufacturer: SCHLUTER SYSTEMS, "JOLLY"
    b. Material: Extruded Aluminum.
    c. Finish: Natural (AN).
    d. Refer to Interior Elevations for location.
2. Cover Base:
    a. Manufacturer: SCHLUTER SYSTEMS, "DILEX-AHKA"
    b. Material: Extruded Aluminum.
    c. Finish: Natural (AN).

B. Membranes:
1. Wall:
    a. Polyethylene, 4 mil sheet with 6 inch laps at wet areas.
    b. Polyethylene, 6 mil sheet with 6 inch laps at shower areas adjacent to concrete or masonry wall areas.
2. Floor:
    a. Mortar bed: Nonplasticized, chlorinated polyethylene sheet faced on both sides with nonwoven polyester fabric; 0.040 inch nominal thickness, water vapor transmission rate 0.040 perms per ASTM E 96 "Test Methods for Water Transmission of Materials," Procedure E.
        1) "Chloraloy" by THE NOBLE COMPANY.
    b. Thin-Set: Nonplasticized, chlorinated polyethylene sheet faced on both sides with nonwoven polyester fabric; 0.030 inch nominal thickness, water vapor transmission rate 0.15 perms per ASTM E 96 "Test Methods for Water Transmission of Materials," Procedure E.
        1) "Nobleseal TS" by THE NOBLE COMPANY.
        2) Approved equivalent: "Dal-Seal CIS" by DALTILE over a skim coat of "Keralastic" + "Kerabond" by MAPEI.

C. Cementitious Backer Units:
1. Provide cementitious backer units complying with ANSI A118.9-1999, in maximum lengths available to minimize end-to-end butt joints.
    a. Thickness: Manufacturer's standard thickness, but not less than 1/2 inch unless otherwise noted.
    b. Width: Manufacturer's standard width, but not less than 32 inches, unless otherwise noted.

D. Miscellaneous Materials:
1. Provide miscellaneous guides, shims, spacers, rust resistant fasteners, etc., applicable to substrates and finish materials necessary for flat and true surfaces that minimize cracks, bulges and uneven surfaces.

E. Cleaners:
1. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

F. Sealers:
1. Grout and Tile Sealer: Manufacturer's standard product for sealing grout joints and tile surfaces that does not change color or appearance of grout or tile.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   2. Verify that concrete substrates for tile floors comply with surface finish requirements in ANSI A108.01 for installations indicated.
      a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
      b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
   3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
   4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.

C. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
   2. Prior to installation of Tile, inspect the installed work executed under other Sections which affect the installation of Tile.
      a. Prepare masonry surfaces with a parge coat and cure so that all surfaces are flat prior to the installation of tile.

B. Protection:
   1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

C. Surface preparation:
   1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
   2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.
   3. Fill cracks, holes, and depressions in concrete substrates for tile floors with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
   4. Maximum backing surface variations shall be as follows:
      a. Mortar Bed at Floors: 1/4 inch in 10 feet from required plane.

D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION

A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.
5. Determine location of all movement/expansion joints before starting tile work.
6. Install Cementitious Backer Units in accordance with Cementitious Backer Unit Board Manufacturer's recommendations.
   a. Shim Cementitious Backer Unit Boards as required for a flat and true surface plane with no bulges or uneven or flared surfaces.
   b. Set shims at fasteners.
   c. Fasten with corrosion resistant, waferhead, self-drilling screws with countersinking ribs, min. 8 gauge. Set flush with Board's surface. Fasten thru shims.
7. Determine location of all toilet accessories before starting tile work.
8. Isolate tile installations from concrete slabs at shower floor areas to minimize cracking of the tile installation systems. Install in accordance with the TCNA recommendations using cleavage membranes.
   a. Provide crack isolation membranes as required in accordance with TCNA installation requirements.
9. Provide wall membranes as required by TCNA installation requirements.

B. Layout:
1. Lines shall be straight and true.
2. Refer to Wall and Floor Pattern Drawing(s) in the Interior and Exterior Color Schedules for layout of patterns.
3. Lay out all tile work to minimize cuts less than one-half in size.
4. Lay out tile wainscots to next full tile beyond dimension shown.

C. Joints
1. General: Movement/Expansion Joints shall be placed in accordance with the TCNA recommendations for placement.
2. Align all wall joints to give straight uniform grout lines, plumb and level.
3. Align all floor joints to give straight uniform grout lines, parallel with walls.
4. All joints shall be uniform in width.
5. Locate expansion joints in the tilework:
   a. Over construction or expansion joints in the backing.
   b. Where backing materials change or change directions.
   c. At wall/floor intersections.
   d. Exterior work:
      1) Not more than 8 - 12 feet in each direction.
   e. Interior work:
      1) Not more than 20 - 25 feet in each direction.
         a) Interior tilework exposed to direct sunlight or moisture: 8 to 12 feet in each direction.
         b) Above ground concrete slab substrate: 8 to 12 feet in each direction.
6. Movement/expansion joint width sizes:
   a. Working Butt Joints 1/4 inch minimum.
   b. Working Lap Joints 1/8 inch minimum.

D. Flatness and Lippage:
1. Maximum lippage between adjacent units: 1/32 inch.

E. Tile System Installations:

1. Interior Floor:
   a. System IFA: Concrete Sub-Floor, thin-set installation: **SYS-IFA.**

1) Use: Dry or Limited water exposure.
2) Method: Dry-set Mortar or Latex-Portland Cement Mortar.
3) Detail Standard: TCNA F113-, 3/32" thin-set Dry-set or Latex-Portland Cement Mortar, Bond Coat, Tile, Grout.
4) Installation Standard:
   a) Tile: ANSI A 108.5.
   b) Grout: ANSI A 108.10.

b. System IFB: Concrete Sub-Floor, mortar bed installation **SYS-IFB.**
1) Use: Dry or Wet (Kitchens and Toilets).
2) Method: Cement Mortar.
3) Detail Standard: TCNA F114 - Cleavage Membrane, Reinforcing, 1-1/4" to 2"- Mortar Bed, Bond Coat, Tile, Epoxy Grout.
4) Flush Grout with tile surface at kitchen floors only.
5) Installation Standard:
   a) Tile: ANSI A 108.1B.
   b) Epoxy Grout: ANSI A 108.6.

c. System IFC: Concrete Sub-Floor, shower receptor mortar bed installation: **SYS-IFC.**
1) Use: Wet Exposure (Showers).
2) Method: Cement Mortar.
3) Detail Standard: TCNA B414 - Tile or Stone, Shower Membrane, 1" to 1-3/4" Reinforced Mortar Bed, Bond Coat Tile, Grout.
4) Installation Standard:
   a) Tile: ANSI A 108.1B.
   b) Grout: ANSI A 108.10.
   c) Shower Pan Membrane ANSI A108.01-3.6

d. System IFD: Concrete Sub-Floor, Cementitious Backer Installation **SYS-IFD**.
1) Use: Wet Exposure (Showers).
2) Method: Latex Portland Cement Mortar.
3) Detail Standard: TCNA B 415 – shower floor membrane, cementitous backer unit over Wood or Metal studs or fiber cement underlayment, reinforced mortar bed, tile.
4) Installation Standard:
   a) Tile: ANSI A 108.5.
   b) Grout: ANSI A 108.10.
   c) Shower Pan Membrane ANSI A108.01-3.6.

2. Interior Wall:
a. System IWA: Masonry or Concrete Walls, thin-set installation **SYS-IWA**.
1) Use: Dry or Limited Water Exposure (Toilets).
2) Method: Cement Mortar.
3) Detail Standard: TCNA W202I - 3/32" Thin-Set Mortar Bed Bond Coat, Tile, Epoxy Grout.
4) Installation Standard:
   a) Tile ANSI A 108.5.
   b) Epoxy Grout ANSI A 108.6.

b. System IWB: Masonry or Concrete Walls, mortar bed installation **SYS-IWB.**
1) Use: Dry or Limited Water Exposure (Toilets).
2) Method: Cement Mortar, Bonded.
3) Detail Standard: TCNA W211 - 3/8" to 3/4" Mortar Bed, Bond Coat, Tile, Grout.
4) Installation Standard:
   a) Tile ANSI A 108.1A, 1B, or 1C.
   b) Grout ANSI A 108.10.

c. System IWC: Masonry or Concrete Walls, Mortar bed installation **SYS-IWC.**

1) Use: Wet Exposure (Showers)
2) Method: Cement Mortar.
3) Detail Standard: TCNA W221 - Membrane, Metal Lath, 3/4" to 1 1/2" Scratch Coat and Epoxy Mortar Bed, Bond Coat, Tile, Epoxy Grout.
4) Installation Standard:
   a) Tile ANSI A 108.1B.
   b) Epoxy Grout ANSI A 108.6.
   c) Waterproof membrane ANSI A108.13.

d. System IWD: Gypsum Board Wall, thin-set installation **SYS-IWD**.
1) Use: Dry Exposure.
2) Method: Dry-Set or Latex-Portland Cement Mortar.
3) Detail Standard: TCNA W243 - Water Resistant Gypsum Board, 3/32" Thin-Set Dry-Set or Latex-Portland Cement Mortar, Bond Coat, Tile, Grout.
4) Installation Standard:
   a) Tile ANSI A 108.5.
   b) Grout ANSI A 108.10.

e. System IWE: Wood Stud Walls, mortar bed installation **SYS-IWE.**
1) Use: Dry or Wet Exposures (Kitchen, Toilets and Showers).
2) Method: Cement Mortar.
3) Detail Standard: TCNA W231 - Cleavage Membrane, Metal Lath, 3/4" to 1-1/2" Scratch Coat and Mortar Bed, Bond Coat, Tile, Grout.
4) Installation Standard:
   a) Tile ANSI A 108.1B.
   b) Grout ANSI A 108.10.
   c) Waterproof membrane ANSI A108.13.

f. System IWF: Metal Stud Walls, mortar bed installation **SYS-IWF**.
1) Use: Dry or Wet Exposure (Kitchen, Toilets and Showers).
2) Method: Cement Mortar.
3) Detail Standard: TCNA W241 - Cleavage Membrane, Metal Lath, 3/4" to 1" Scratch Coat and Mortar Bed, Bond Coat, Tile, Grout.
4) Installation Standard:
   a) Waterproof membrane ANSI A108.13.
   b) Cured Mortar Bed.
   c) Tile ANSI A 108.1B.
   d) Grout ANSI A 108.10.

g. System IWG: Wood/Metal Studs, Cement board, medium bed installation **SYS-IWG**.
1) Use: Dry Exposure, Large Format and/or Gauged Tiles.
2) Method: Cement Board and Modified Dry-Set Cement Mortar.
3) Detail Standard: TCNA W244C – 1/2"Cement Backer Board, 3/4" max Medium Bed Bond Coat, Tile, Epoxy Grout.
4) Flatness tolerance: 1/8" max in 10 feet, with 1/16" in 2 feet.
5) Installation Standard:
   a) Cement Backer Board ANSI A108.11.
   b) Tile ANSI A108.4 or A108.5
   c) Epoxy Grout ANSI A108.6.

3. Exterior Wall:
a. System EWA: Masonry or Concrete Walls, 3/4" to 1" mortar bed installation **SYS-EWA.**
1) Use: Dry or Wet Exposure.
2) Method: Cement Mortar.
3) Detail Standard: TCNA W201 - Wall Membrane, Metal Lath, 3/4" To 1" Scratch Coat/Mortar Bed, Bond Coat, Tile, Grout.

4) Installation Standard:
a) Waterproof Membrane ANSI A108.13.
b) Tile ANSI A 108.1B.
c) Grout ANSI A 108.10.

b. System EWB: Solid Backing Walls, 3/8" to 3/4" reinforced mortar bed **SYS-EWB**.
1) Use: Dry or Wet Exposure.
2) Method: Cement Mortar.
3) Detail Standard: TCNA W221 - Wall Membrane, Metal Lath, 3/8" To 3/4" Scratch Coat/Mortar Bed, Bond Coat, Tile, Grout.
4) Installation Standard:
a) Waterproof Membrane ANSI A108.13.
b) Tile ANSI A 108.1A, 1B, or 1C A108.1B is required if waterproof membrane or epoxy bond coat is to be used.
c) Grout ANSI A 108.10.

c. System EWC: Metal Stud Walls, 3/4" to 1" mortar bed, exterior walls **SYS-EWC**.
1) Use: Dry or Wet Exposure.
2) Method: Cement Mortar.
3) Detail Standard: TCNA W241 - Wall Membrane, Metal Lath, 3/4" To 1" Scratch Coat/Mortar Bed.
a) At exterior Tile locations include: Bond Coat, Tile, Grout.
4) Installation Standard:
a) Waterproof Membrane ANSI A108.13.
b) Tile ANSI A 108.1A, 1B, or 1C A108.1B is required if waterproof membrane or epoxy bond coat is to be used.
c) Grout ANSI A 108.10.

4. Sealer Application:
a. For tile and grout sealers, follow manufacturer's written recommendations and procedures, at application rates recommended by the label on the material container.
b. Apply penetrating grout sealer and cure in accordance with tile manufacturer's written recommendations for the resistance of moisture penetration into the grout surface.
c. For Stone Tile and Stone Grout sealers, apply at a rate of 500 to 1,500 sq. ft. per coat per gallon, depending on type of stone (slate), porosity and texture of the surface, temperature, humidity and method of application.
d. For exterior Stone Tile applications, provide two coats of sealer per manufacturer's written recommended rate of application, allowing the proper time between coats for curing (30 minutes) as recommended by the manufacturer.
1) Protect newly coated surface from traffic and moisture for a period of twelve hours.

F. Curing:
1. Apply Curing Sheet over all tiled surfaces.
a. Lap sheets 4 inches minimum and seal against escape of moisture.
b. Leave Curing Sheets in place a minimum of 3 days.

3.4 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
B. Clean any soiled surfaces immediately.
C. Finish shall be clean and ready for the application of any additional finishes.
D. In accordance with manufacturer's written instructions and recommendations.

E. Wash down cured tile work with cleaner mixed and applied in accordance with manufacturer's written instructions.

F. Rinse tile-work thoroughly, with clean water, and polish with soft-cloth.

3.5 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Protect newly installed work from freezing for 24 hours after erection, installation or application.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

END OF SECTION

SECTION 09 50 00 – ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all Acoustical Ceiling Materials, Suspension Systems, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 04 22 00 CONCRETE MASONRY UNITS
4. 05 12 00 STEEL AND FABRICATIONS
5. 05 30 00 METAL DECK
6. 06 10 00 ROUGH CARPENTRY
7. 06 17 13 COMPOSITE LUMBER
8. 07 21 00 INSULATION
9. 07 81 16 FIREPROOFING
10. 09 22 16 METAL FRAMING
11. 09 24 00 CEMENT PLASTER
12. 09 29 00 GYPSUM BOARD
13. 09 72 00 WALL COVERINGS
14. 09 91 00 PAINTING
15. 10 05 00 MISCELLANEOUS SPECIALTIES
16. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:

1. In accordance with the following standards:
   a. CISCA Ceilings & Interior Systems Construction Association.

1.3 SYSTEM DESCRIPTION

A. Suspension System Design Requirements: In accordance with allowable values and properties assigned and approved by CBC.

1. Heavy Duty in accordance with ASTM C 635 "Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and lay-in Panel Ceilings," ASTM E 580 "Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint," Section 5.1, ASCE 7 as modified by CBC Sections 1617A.1.21, 2506.2.1, and DSA IR 25-2.
2. Design Weight: Total Weight does not exceed four (4) pounds per square foot, including air conditioning grilles and light fixtures.
3. System is not to support lateral loads from partitions.
4. Fasteners must be capable of sustaining, without failure, hanger wires with 200 lbs. tension load and bracing wires with 440 lbs. tension load.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Product Data.
   a. Manufacturers Product Information for each type of Acoustical Ceiling Tile or Panel scheduled to be used.

b. Manufacturers Product Information for each component of the Suspension System specified or scheduled.

2. Shop Drawings.
   a. Submit shop drawings from manufacturer detailing ceiling suspension system assemblies and indicating dimensions, method of field assembly (including hanger and bracing wires, compression struts, wall angle attachments), other components, and location and detail of each suspension system grid connection.
      1) Submit drawings showing details of Hanger Wires, Brace Wires, expansion joint locations, and Compression Strut connections to structure and to suspension system.
3. Samples.
   a. Provide 4 to 6 inch square sample for each type of Acoustical Ceiling Tile or Panel scheduled to be used.
   b. Provide 12 inch lineal sample of Suspension System components for each type of system specified or scheduled.
4. Quality Assurance/Control Submittals:
   a. Test Reports:
      1) Tension Tests of acoustical ceiling wire anchors provided by Testing Agency.
   b. Certificates:
      1) General Construction: Certification signed by the Contractor on Contractor's letterhead.
      2) Certificates signed by manufacturers of Acoustical Ceiling components certifying that their products comply with specified requirements.
   c. Manufacturer's Written Instructions:
      1) Manufacturer's written instructions showing their suspension grid installation methods.
5. Closeout Submittals in accordance with the following:
   a. In accordance with Specification Section - PROJECT DOCUMENTS.
   b. Warranty in accordance with Specification Section - WARRANTIES.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Material Qualifications:
      a. Where fire-rated Acoustical Ceiling assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per UL or ASTM E 119 "Test Methods for Fire Tests of Building Construction and Materials," by an independent testing and inspecting agency acceptable to the California State Fire Marshal.
      b. Source Limitations:
         1) Acoustical Ceiling Tiles or Panels: Obtain each type through one source from a single manufacturer.
         2) Suspension Systems: Obtain each type through one source from a single manufacturer.
   2. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
         1) Helpers and apprentices used for such work shall be under full and constant supervision at all times by thoroughly skilled Acoustical Ceiling and Suspension System installers.
         2) In the acceptance or rejection of installed Acoustical Ceiling or Suspension Systems, no allowance will be made for lack of skill on the part of the installers.

3. Manufacturer/Supplier Qualifications:
   a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
   b. Products, materials and evaluation reports to comply with IR-A5.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
   a. CBC California Building Code (CBC 803.1.1)
   b. CDPH California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers”
   c. CSFM California State Fire Marshal.
   d. FDA Food and Drug Administration, a department of US Department of Health and Human Services.
   e. IR Interpretation of Regulations.
   f. USDA/FSIS United States Department of Agriculture., Food Safety and Inspection Service.

C. Certificates:
1. General Construction: Contractor to certify that work provided, meets or exceeds the requirements of this section.
2. Products: Manufacturers of Acoustical Ceiling components shall certify that their products comply with specified requirements.

D. Meetings:
1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
   a. Coordinate the work with other work being performed.
   b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
   a. Review for proper installation of work progress.
   b. Identify any installation problems and acceptable corrective measures.
   c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
   a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
   b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:
1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
2. Damaged products will not be accepted.

C. Storage and protection:
1. Products shall be stored in a fully enclosed, conditioned space and protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination and other causes.

1.7 PROJECT CONDITIONS

A. Environmental requirements:

1. Do not install acoustical ceilings until spaces are enclosed and weatherproof.
2. Wet work and dry work in spaces is completed, dry and dust free.
3. Work above ceilings is completed.
4. Ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

1.8 SEQUENCING AND SCHEDULING
A. Coordination:
1. Coordinate layout and installation of Acoustical Ceiling Tiles, Panels and the Suspension Systems with other construction that penetrates ceilings or is supported, including light fixtures, HVAC equipment, smoke monitoring and fire-suppression systems.

1.9 WARRANTY
A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.
B. Manufacturer’s Warranty:
1. In accordance with manufacturer's written standard warranty:
a. Warranty Period One (1) Year.
C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES:
a. Warranty period [One (1) Year.][Five (5) years.]

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Products specified are from companies listed below, or approved equivalent. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers listed as acceptable alternative manufacturers must still comply with the requirements of the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
1. Specified Tile and Panel product manufacturer:
a. ARMSTRONG WORLD INDUSTRIES.
b. Acceptable alternative manufacturers:
1) CERTAINTEED.
2) UNITED STATES GYPSUM COMPANY, USG INTERIORS.
2. Specified Suspension System product manufacturer:
a. ARMSTRONG WORLD INDUSTRIES.
b. Acceptable alternative manufacturers:
1) ROCKFON NORTH AMERICA - CHICAGO METALLIC CORPORATION.
B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS
A. Tile or Panel:

1. General:
   a. Standard: Provide manufacturer's standard tile or panels of configuration indicated that comply with ASTM E 1264 "Standard Classification for Acoustical Ceiling Products" classifications as designed by type, pattern, acoustical rating, light reflectance, and fire-rating, unless otherwise indicated.
   b. Colors and Patterns: Match appearance characteristics indicated for each product type.
   c. Antimicrobial Treated:
      1) Coating-Based: Provide tile or panel face surfaces (front and back) with coated antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 "Standard Test method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber."
      2) Panel-Base: Provide tiles or panels treated with manufacturers standard antimicrobial solution that inhibits fungus, mold, mildew, gram-positive and gram-negative bacteria.
2. See the Acoustical Tile and Panel Schedule at the end of this section for specified tile or panel types.

B. Suspension Systems:
1. General:
   a. Classification of Suspension System Grid is Heavy Duty in accordance with ASTM C 635 "Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and lay-in Panel Ceilings," ASTM E 580 "Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint," Section 5.1, ASCE 7 as modified by CBC Sections 1617A.1.21, 2506.2.1, and DSA IR 25-2.
   b. Provide Underwriter's Laboratory (UL) design number or California State Fire Marshal (CSFM) Listing number for the fire-rated ceiling assembly.
      1) The components and installation details must conform in every respect with the UL or CSFM approval for the design number specified.
      2) Custom designs which combine components from different approval designs but have not been tested as a complete assembly are not acceptable.
      3) See Exposed Grid at end of this section for specified system numbers.
2. Wire:
   a. Soft temper, Class 1 zinc coating, in accordance with ASTM A 641 "Specification for Zinc-Coated (Galvanized) Carbon Steel Wire."
      1) Hanger: 12 gage (0.106 inch diameter).
      2) Brace: 12 gage (0.106 inch diameter).
3. Clip Attachments:
   a. General: Fabricate from corrosion-resistant material with holes or loops for attaching hanger and brace wires.
      1) Ceiling Clips: 3/4" wide x 13 gage, galvanized steel.
      2) Steel Straps:
         a) 1" wide x length as required, 12 gage galvanized steel.
         b) 3" wide x 4" long x 12 gage galvanized steel.
4. Grid:
   a. Grid System shall be manufactured from commercial quality galvanized steel.
   b. All Tee Grid System Numbers are from ARMSTRONG WORLD INDUSTRIES.
      1) Exposed Non-Rated 15/16" Tee Grid System "Prelude XL" (P-XL).

2) Exposed Fire-Rated 15/16" Tee Grid System "Prelude XL Fire Guard" (P-XL).
3) Exposed Non-Rated 9/16" Tee Grid System "Suprafine XL" (S-XL).

c. Main Runners:

1) Main Runner – Non-Rated 15/16" #P-XL 7301.
2) Main Runner – Fire-Rated 15/16" #P-XL 8301.
3) Main Runner - Non-Rated 9/16" #S-XL 7501.
4) Capped, Double-Web roll-formed from cold-rolled steel sheets, pre-painted with factory punched cross runner slots, hanger holes and integral bayonet style and couplings.
5) Fire-rated: Manufactured with fire-expansion reliefs.

d. Cross Runners:

1) 2' Non-Rated Cross Runner 15/16" #P-XL 7328.
2) 4' Non-Rated Cross Runner 15/16" #P-XL 7341.
3) 2' Fire-Rated Cross Runner 15/16" #P-XL 8323.
4) 4' Fire-Rated Cross Runner 15/16" #P-XL 8341.
5) 2' Non-Rated Cross Runner 9/16" #S-XL 7520.
6) 4' Non-Rated Cross Runner 9/16" #S-XL 7540.
7) Capped, Double-Web roll-formed from cold-rolled steel sheets, pre-painted with factory punched cross runner slots and hanger holes.
8) Fire-rated: Manufactured with fire-expansion reliefs.

e. Wall Angles:

1) "Angle" Ceiling Edge Trim, hemmed exposed edges, 7/8" x 7/8", #7800.
2) "Angle" Ceiling Edge Trim, hemmed exposed edges, 2" x 2", #7808.
3) Roll-formed of sheet metal of same gage and finish as the main runners.
4) Provide wall angles fabricated to diameter required to fit circular penetrations of ceilings exactly.

f. Panel Hold Down Clips:

1) Hold Down Clip #P-XL 414.

g. Compression Struts (Metal angles, galvanized steel):

1) 1/8 inch thick x 1 inch x 1 inch 800 lbs./1000 feet weight.
2) 3/16 inch thick x 1-1/4 inch x 1-1/4 inch 1,480 lbs./1000 feet weight.
3) 3/16 inch thick x 1-1/2 inch x 1-1/2 inch 1,800 lbs./1000 feet weight.
4) 3/16 inch thick x 1-3/4 inch x 1-3/4 inch 2,120 lbs./1000 feet weight.
5) 3/16 inch thick x 2 inch x 2 inch 2,440 lbs./1000 feet weight.
6) 3/16 inch thick x 2 inch x 2-1/2 inch 3,070 lbs./1000 feet weight.
7) 3/16 inch thick x 3 inch x 3 inch 3,710 lbs./1000 feet weight.
8) 1/4 inch thick x 3-1/2 inch x 3-1/2 inch 5,800 lbs./1000 feet weight.
9) 1/4 inch thick x 4 inch x 4 inch 6,600 lbs./1000 feet weight
10) Alternate Compression Struts Refer to drawings.
    a) Must be submitted to and approved by DSA.

h. Seismic Clips:

1) Seismic Perimeter Clips #BERC2.

i. Cold Rolled Channels, 16 gage galvanized steel:

1) 1-1/2" x 17/32" flange 475 lbs/1000 feet weight.

2.3 ACCESSORIES

A. Fasteners:

1. Wood Construction:
   a. Provide corrosion-resistant materials.
   b. Eye screws, minimum 1/4 inch diameter, 1-1/4 inch minimum embedment.

c. Staples, 1-1/2 inch x 0.148 inch diameter (9 gage).
d. Nails, STRONGHOLD "J" nails.

2. Steel Framing:
   a. Shot-in Anchors.
3. Metal Deck or Metal Deck without Structural Concrete:
   a. Self-tapping Screws.
4. Metal Deck or Metal Deck with Structural Concrete or Concrete:
   a. Shot-in Anchors (hanger wire only).
   b. Drilled-in Anchors.
5. Suspension System Fasteners, runner to wall angle:
   a. Pop rivets as standard with the manufacturer, heads to match the finish of the main runners.
      1) Pop-rivets, screws or other attachments are not acceptable unless specifically detailed on the manufacturer's drawings and approved by UL and the CSFM.

B. Adhesives:
1. Provide adhesives that comply with all requirements of ASTM D 1779 "Standard Specification for Adhesive for Acoustical Materials," for non-rated and fire-rated assemblies, and shall be compatible with the substrate to which the tile is to be installed as well as the tile material selected, and shall be UL Labeled for Class 0 - 25 Flame Spread..

C. Sealants:
1. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834 "Specification for Latex Sealants," and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90 "Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements."
2. Acoustical Sealant for Concealed Joints: Manufacturer's standard non-drying, non-hardening, non-skinning, non-staining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

D. Other Materials: All other miscellaneous materials, not specifically described, but required for a complete and proper installation of acoustical ceilings, shall be as selected by the Contractor subject to the approval of the Architect.

2.4 FINISHES

A. Factory Finish:
1. Suspension System: Manufacturer's standard baked-on enamel finish to all members. All fasteners shall match the main runner finishes.
   a. General: Comply with NAAMM's "Metal Finishes manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Tile or Panel: Refer to Tile and Panel Schedule for finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, examine substrates, areas, and conditions, including structural framing to which acoustical ceilings attach or abut, with installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical ceilings.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.

3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
   2. Coordinate proper placement of ceiling mounted tracks, accessories, light fixtures, HVAC registers and other items which are to be integrated with acoustical ceilings.
   3. Measure each ceiling area and establish layout of acoustical tiles or panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles or panels at borders, and comply with layout shown on reflected ceiling plans.

B. Protection:
   1. Do not begin work until all rooms have been protected against the weather.
   2. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

C. Surface preparation:
   1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
   2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

3.3 INSTALLATION

A. General:
   1. In accordance with manufacturer's written instructions and recommendations along with CISCA's "Ceiling Systems Handbook" and USDA.
   2. In accordance with approved Submittals.
   3. In accordance with Regulatory Requirements.
   4. Installation shall comply with ASTM C 636 "Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels," and ASTM E 580 "Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint," Section 5.2.
   5. Installation shall also comply with CBC Section 1617A.1.21, 2506.2.1, and DSA IR 25-2.

B. Layout:
   1. Lines shall be straight and true.
   2. Set plumb, level, and square.

C. Suspension System:
   1. 12 gage (minimum) hanger wires may be used for up to and including 4'-0" x 4'-0" grid spacing and attached to main runners. Splices will not be permitted in any hanger wires unless specifically approved by DSA/SSS.
   2. Provide 12 gage hanger wires at ends of all main and cross runners within 8" from the support or within 1/4 of the length of the end tee, whichever is least, for the perimeter of the ceiling area.
      a. End connections for runners, which are designed and detailed to resist the applied horizontal forces may be used in lieu of the 12 gage hanger wires subject to DSA/SSS review and approval.
      b. Perimeter wires are not required when the length of the end tee is 8" or less.
   3. Provide trapeze or other supplementary support members at obstructions to maintain hanger spacing.
      a. Provide additional hangers, struts or braces as required at all ceiling breaks, soffits or discontinuous areas.
      b. Hanger wires that are more than 1 in 6 out of plumb are to have counter-sloping wires.

4. Ceiling grid members may be attached to not more than 2 adjacent walls. Ceiling grid members should be at least 3/4 inch free of other walls.
    a. If walls run diagonally to ceiling grid system runners, one end of main and cross runners should be free and a minimum of 3/4 inch clear of wall.
    b. Pop rivets, screws, or other attachments in fire-rated ceilings shall not be acceptable unless specifically detailed on the manufacturer's drawings and approved by UL and DSA/FLS.
5. At the perimeter of the ceiling area where main or cross runners are not connected to the adjacent wall, provide Seismic Perimeter Clip, installed in accordance with manufacturer's instructions and ICC-ES Evaluation Report.
6. Provide bracing assemblies consisting of a compression strut and slotted angle spacer of four (4) 12 gage splayed bracing wires oriented 90 degrees from each other.
    a. Bracing assemblies shall be provided for each 144 square feet of ceiling area.
        1) Spaced not more than 12 feet by 12 feet on center.
    b. Bracing assemblies shall be located not more than 1/2 the above spacing from each perimeter wall or at the edge of vertical ceiling offsets.
    c. The slope of these wires should not exceed 45 degrees from the plane of the ceiling and should be taut without causing the ceiling to lift.
    d. Splices in bracing wires are not permitted unless specifically approved by DSA/SSS.
    e. Fire-Rated Asemblies shall have a bracing assembly for each 96 square feet.
        1) The first bracing assembly is required not more than four feet (4'-0") from each wall.
        2) A minimum of one bracing assembly is required between any two adjacent expansion cut-outs on runners being braced.
    f. Bracing assemblies are not required where the ceiling area is:
        1) 144 sq.ft. or less.
7. Fasten hanger wires with not less than 3 tight turns. Fasten bracing wires with 4 tight turns.
    a. Make all tight turns within a distance of 1-1/2 inches.
    b. Hanger or bracing wire anchors to the structure should be installed in such a manner that the direction of the wire aligns as closely as possible with the direction of the forces acting on the wire.
8. Separate all ceiling hanging and bracing wires at least 6 inches from all unbraced ducts, pipes, conduit, etc.
    a. It is acceptable to attach lightweight items, such as single electrical conduit not exceeding 3/4" nominal diameter, to hanger wires using connectors acceptable to DSA/SSS.
9. Attach all light fixtures and ceiling mounted air terminals or services to the ceiling grid runners to resist a horizontal force equal to the weight of the fixtures.
    a. Approved screws or fasteners are required.
10. Flush or recessed light fixtures weighing less than 56 pounds and mechanical terminals and services weighing less than 20 lbs. may be supported directly on the runners of a heavy duty grid system but, in addition, they must have a minimum of two (2) 12 gage slack safety wires attached to the fixture at diagonal corners and anchored to the structure above.
    a. All 4 ft. x 4 ft. fixtures must have slack safety wires at each corner.
11. All flush or recessed light fixtures weighing 56 pounds or more and mechanical terminals and services weighing 20 lbs. or more shall be independently supported by not less than four (4) taut #12 gage wires each attached to the fixture.

a. Wires and their attachment to the structure must be capable of supporting 4 times the weight of the unit and attached to the structure above regardless of the type of ceiling grid system used.

12. Support surface mounted light fixtures by at least two positive devices which surround the runner and which are each supported from the structure above with 12 gage wire.
    a. Spring clips or clamps that connect only the runner are not acceptable.
    b. Provide additional supports when light fixtures are 8'-0" or longer.
13. Support pendant mounted light fixtures directly from the structure above with hanger wires or cables passing through each pendant hanger and capable of supporting four (4) times the weight of the fixture.
    a. Bracing assembly is required where the pendant hanger penetrates the ceiling.
    b. Pendant hanger is required to attach to the bracing assembly to transmit horizontal forces.
    c. Maximum spacing between supports shall not exceed 8 feet.
14. Ceiling Edge Condition:
    a. Where Grid System abuts wall, fasten wall angles to framing in wall structure.
        1) At Wood Framing, attach to backing with No. 10 x 3" Screws at 16" o.c.
        2) At Metal Framing, attach to metal framing backing with No. 8 self-tapping sheet metal screws at 16" o.c.
    b. Where Grid System terminates free from wall, fasten wall angles to Grid system with Fasteners. No screw or rivets shall appear on any exposed surface.
15. Supplemental Support Members:
    a. Where the width of ducts or other obstructions interfere with typical hangers and bracing assemblies, provide and install supplemental members and hangers in the form of trapeze or equivalent devices.
    b. Provide additional hangers, struts, or braces at all ceiling breaks, soffits, or discontinuous areas.
    c. Hanger wires that are more than one (1) horizontal in six (6) vertical shall have counter-sloping wires.
16. Expansion Joints:
    a. Expansion Joints shall be provided and installed in the ceiling at intersections of corridors and junctions of corridors with lobbies or other similar areas.
17. Expansion Joints shall be provided and installed in ceiling areas exceeding 2,500 sq.ft. in order to separate ceilings into areas not exceeding 2,500 sq.ft.

D. Suspended Acoustical Ceiling Panels:
1. Install acoustical ceiling panels with undamaged edges and fit accurately into suspension system runners and wall angles. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
    a. Install panels with pattern running in one direction.
2. Paint cut edges of panels remaining exposed after installation.
    a. Match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical ceiling manufacturer.
3. Install hold down clips at all Fire-Rated acoustical ceiling assemblies, food preparation areas, and at locker/shower areas.
4. Penetrations through the ceiling for sprinkler heads and other similar devices that are not integrally tied to the ceiling system in the lateral direction shall have a two (2) inch oversized ring, sleeve, or adapter through the ceiling tile to allow free movement of one (1) inch in all horizontal directions. Alternatively, swing joints may be provided per ASTM E 580, Section 5.2.8.5.

E. Adhesively applied Acoustical Tiles:
1. Installation shall comply to ASTM D 1779 "Standard Specification for Adhesive for Acoustical Materials."

3.4 FIELD QUALITY CONTROL

A. Site Tests:

1. Testing Agency: The Owner's Testing Laboratory Agency shall perform field tests and Inspections and prepare test reports.
   a. Testing and inspecting of completed installations of acoustical ceiling fasteners and anchors shall take place in successive stages, in areas of extent and using methods as follows.
   b. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
2. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed:
   a. Concrete Anchors:
      1) Must be capable of sustaining, without failure, a load equal to 200 lbs. tension for hanger wires and 440 lbs. tension for bracing wires by construction as determined by testing according to ASTM E 488 "Test methods for Strength of Anchors in Concrete and Masonry Elements," by a qualified independent testing agency.
         a) Hanger Wire Anchors 1 in 10 must be field tested.
         b) Bracing Wire Anchors 1 in 2 must be field tested.
3. Remove and replace acoustical panel ceiling hangers where test results indicate that they do not comply with specified requirements.
4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
   a. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

B. Inspection:

1. As required by Regulatory Requirements.
2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
3. No work shall be without the inspections required by Regulatory Requirements.

3.5 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.

1. Clean any soiled surfaces immediately.
2. Clean any soiled surfaces at the end of each day, minimum.
3. Finish shall be clean and ready for the application of any additional finishes.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturers written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.6 SCHEDULES

A. Tile and Panel Schedule:

1. TYPE ACT-II:
   a. Design "School Zone Fine Fissured" No. 1811, Panel.
   b. Manufacturer ARMSTRONG WORLD INDUSTRIES.
   c. Material:
      1) Wet-Formed mineral fiber, with factory-applied vinyl latex paint surface finish.
   d. Size 24" x 48" x 5/8" panel – "Square Cut" lay-in edge.
   e. Mounting 15/16" Fire-Rated exposed tee grid.

f. NRC Rating 0.70.
g. CAC 40.
h. Light Reflectance per ASTM E 1477 "Test method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers":
   1) 0.81.
i. ASTM Classification per ASTM E 1264 "Classification for Acoustical Ceiling Products":
   1) Type III, Form 2, Pattern C D.
j. Class A per ASTM E 84 "Test method for Surface burning Characteristics of Building Materials":
   1) Flame Spread Index 25 or under.
   2) Smoke Density Developed Index 50 or less.
k. Color "White."
l. Antimicrobial Treatment Bio Block.

2. TYPE ACT-V:
   a. Manufacturer ARMSTRONG WORLD INDUSTRIES.
   b. Design "Cirrus Tegular, Fine Texture" No. 584, Panel.
   c. Material:
      1) Wet-Formed mineral fiber, with factory-applied vinyl latex paint surface finish.
   d. Size 24" x 24" x 3/4" panel – Angled "Tegular" lay-in edge.
   e. Mounting 15/16" Non-Rated exposed tee grid.
   f. NRC Rating 0.70.
   g. CAC Range 35.
   h. Light Reflectance per ASTM E 1477 "Test method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers":
      1) 0.86.
   i. ASTM Classification per ASTM E 1264 "Classification for Acoustical Ceiling Products":
      1) Type III, Form 1, Pattern E L.
   j. Class A per ASTM E 84 "Test method for Surface burning Characteristics of Building Materials":
      1) Flame Spread Index 25 or under.
      2) Smoke Density Developed Index 50 or less.
   k. Color "White."
   l. Antimicrobial Treatment None.

3. TYPE ACT-VI:
   a. Manufacturer ARMSTRONG WORLD INDUSTRIES.
   b. Design "Cirrus Tegular, Fine Texture" "FireGuard" No. 578, Panel.
   c. Material:
      1) Wet-Formed mineral fiber, with factory-applied vinyl latex paint surface finish.
   d. Size 24" x 24" x 3/4" panel – Angled Tegular lay-in edge.
   e. Mounting 15/16" Fire-Rated exposed tee grid.
   f. NRC Rating 0.35.
   g. CAC 35.
   h. Light Reflectance per ASTM E 1477 "Test method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers":
      1) 0.86.

i. ASTM Classification per ASTM E 1264 "Classification for Acoustical Ceiling Products":
   1) Type III, Form 1, Pattern E L.
j. Class A per ASTM E 84 "Test method for Surface burning Characteristics of Building Materials":
   1) Flame Spread Index 25 or under.
   2) Smoke Density Developed Index 50 or less.
k. Color "White."
l. Antimicrobial Treatment None.

4. TYPE ACT-VIII:
   a. Manufacturer ARMSTRONG WORLD INDUSTRIES.
   b. Design:
      1) "Ceramaguard" Non-Perforated, Medium Texture "Fire Guard" No. 605, Fire-Rated Panel.
   c. Material:
      1) Ceramic and mineral fiber composite, with a scrubbable factory-applied plastic paint surface finish.
   d. Size 24" x 48" x 5/8" panel – "Square-Cut" lay-in edge.
   e. Mounting 15/16" Fire-Rated exposed tee grid.
   f. NRC Rating N/A.
   g. CAC 40.
   h. Light Reflectance per ASTM E 1477 "Test method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers":
      1) 0.88.
   i. ASTM Classification per ASTM E 1264 "Classification for Acoustical Ceiling Products":
      1) Type XX, Pattern G.
   j. Class A per ASTM E 84 "Test method for Surface burning Characteristics of Building Materials":
      1) Flame Spread Index 25 or under.
      2) Smoke Density Developed Index 50 or less.
   k. Color "White."
   l. Antimicrobial Treatment Inherent.

END OF SECTION

SECTION 09 65 10 – RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all Resilient Base and Accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 03 30 00 CAST-IN-PLACE CONCRETE
   4. 03 35 10 POLISHED CONCRETE FINISHING
   5. 04 20 00 CONCRETE MASONRY UNITS
   6. 06 10 00 ROUGH CARPENTRY
   7. 06 22 00 MILLWORK
   8. 06 41 23 MODULAR CASEWORK
   9. 09 24 00 CEMENT PLASTER
   10. 09 29 00 GYPSUM BOARD
   11. 09 56 19 RESILIENT TILE
   12. 09 68 40 CARPET
   13. 09 72 00 WALL COVERINGS
   14. 09 91 00 PAINTING
   15. 10 05 00 MISCELLANEOUS SPECIALTIES
   16. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with Specification Section - Regulatory Requirements, and the following standards:
      a. ADAAG Americans with Disabilities Act Accessibilities Guidelines.
      b. RFCI The Resilient Floor Covering Institute.

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product Data:
      a. For each type of resilient base and accessory indicated.
      b. Manufacturer's full color range (including any standard and premium colors).
      c. Design Data for all compounds, fillers, adhesives, etc.
   2. Samples.
      a. Provide 6 inch linear samples of each piece of trim material specified.
   3. Quality Assurance/Control Submittals:
      a. Manufacturer's Written Installation Instructions.
      b. Certificate from resilient base installer that all products supplied for installation comply with local regulations in the area where the project is located controlling the use of Volatile Organic Compounds (VOC's).
      c. Statement of Installer’s Qualifications.
   4. Closeout Submittals in accordance with Specification Sections in Division One:

a. Maintenance Data (including recommended polish and buffing procedures) in accordance with Specification Section - PROJECT CLOSEOUT.
b. Record Documents in accordance with Specification Section – PROJECT DOCUMENTS.
c. Warranty in accordance with this Specification Section, and Specification Section – WARRANTIES.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Installer Qualifications:
a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project, and is competent in the techniques required by the manufacturer.
2. Manufacturer/Supplier Qualifications:
a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
a. CBC California Building Code (CBC 11B-302.1)

C. Meetings:
1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
a. Coordinate the work with other work being performed.
b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
c. Review delivery, storage, and handling procedures.
d. Review Project Conditions.
e. Review subfloor preparation procedures.
2. Progress: Scheduled by the Contractor during the performance of the work.
a. Review for proper installation of work progress.
b. Identify any installation problems and acceptable corrective measures.
c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:
1. Products must be in manufacturer's original unopened containers with labels indicating brand name, type, color, and size.
2. Damaged products will not be accepted.

C. Storage and protection:
1. Products shall be stored in a dry, protected, interior area above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.

a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

b. Maintain temperature in the storage space between fifty (50) degrees Fahrenheit and ninety (90) degrees Fahrenheit.

1) Seven (7) days prior to installation, acclimate products to environmental requirements of the article titled PROJECT CONDITIONS of this specification section, and the Paragraph titled "Environmental Requirements."

1.6 PROJECT CONDITIONS

A. Environmental requirements:

1. Temperature: Maintain temperature in space to receive products at sixty-eight (68) degrees Fahrenheit for two (2) days prior, during, and two (2) days following installation.

a. After this period, maintain a temperature of not less than fifty-five (55) degrees Fahrenheit.

b. After installation, at no such time shall the temperature exceed eighty-five (85) degrees Fahrenheit.

B. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

2. Field Measurements:

a. Take and be responsible for field measurements as required.

b. Report any significant differences between field dimensions and drawings to the Architect.

1.7 WARRANTY

A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:

1. In accordance with manufacturer's written standard warranty:

a. Rubber Base Two (2) Years.

b. Transitions Two (2) years.

C. Installer's Warranty:

1. In accordance with the terms of the Specification Section - WARRANTIES:

a. Warranty Period Two (2) Years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Rubber Base manufacturer:

a. MANNINGTON COMMERCIAL

b. Acceptable alternative manufacturers:
1) ROPPE CORPORATION.

2. Transitions manufacturer:
a. MANNINGTON COMMERCIAL.
b. Acceptable alternative manufacturers:
1) ROPPE CORPORATION.

3. Underlayment Compound manufacturer:
a. ARDEX INCORPORATED.
b. Acceptable alternative manufacturers:
1) CHEMREX.
a) A compatible bonding agent is needed for this product to adhere to the Vapor-Alkalinity Control System and be considered as equivalent.

4. Crack and Joint Filler manufacturer:
a. ARDEX INCORPORATED.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. General:
1. Resilient base and accessories shall be of first quality and the product of one manufacturer.
2. Stair Treads shall be slip resistant by achieving a minimum 0.6 or greater static coefficient of friction as recommended in Appendix A4.5 of the ADAAG by testing per ASTM D 2047 "Test method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine."
3. Colors and patterns shall be selected from manufacturer's standard line (including premium) except as noted otherwise.
a. Stair treads, risers, and stringers shall be of the same color or matching color and product line.
4. All resilient base and accessories shall be impervious to water damage.
5. Minimize seams.

B. Rubber Base:
1. Shall comply with ASTM F 1861 "Standard Specification for Resilient Wall Base," for Type TS (Vulcanized Rubber), Group 1 (Solid and Homogeneous).
a. Critical Radiant Flux shall be Class 1, not less than 0.45 W/sq.cm. per ASTM E 648 "Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source."
2. Base shall be [Coved]
3. Thickness: 0.125".
4. Base height shall be [**4"**]
5. Length: as long as possible to reduce seams.
6. Provide factory molded inside and outside base corners from the same dye lot as the rubber base.

C. Transitions:
1. Include molding caps, dividers, edges, cove supports, feature strips, reducers, stair nosings, etc.
2. Shall be composed of Thermoplastic Vinyl throughout item.
a. Stair Nosings shall be Thermoplastic Rubber (Vulcanized Rubber).

3. Critical Radiant Flux shall be Class 1, not less than 0.45 W/sq.cm. per ASTM E 648 "Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source."
4. Shall comply to dimension requirements of section 4.5.2 (changes in level) and section 4.5.3 (carpet-edge trim) of the ADAAG.
5. Stair nosings shall provide color contrasting integral insert for the visually impaired as indicated.

2.3 ACCESSORIES

A. Underlayment Compound:
1. Provide free-flowing, self-leveling, pumpable, cement based compound (ARDEX K-15) for applications from 1 inch thick to feathered edges, 4000 psi minimum in accordance with ASTM C 109-modified for air cure only "Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens)."
   a. ARDEX "K-15."

B. Crack and Joint Filler:
1. Provide low viscosity rigid polyurethane filler, tensile strength of 4,000 psi minimum, in accordance with ASTM D 638 "Test method for Tensile Properties of Plastics."
   a. ARDEX "ARDIFIX".

C. Concrete Primer (if applicable):
1. Nonstaining type as recommended in writing by flooring manufacturer.

D. Adhesives:
1. Adhesive as recommended in writing by resilient base manufacturer.
   a. Provide manufacturer's written recommended epoxy adhesive at all rubber stair accessories and rubber stair nosings.
2. Compatible with Vapor-Alkalinity Control System, if installed.
3. Shall comply with requirements in the place where the project is located.
4. Shall be water and mildew resistant.
5. Shall bond to non-porous substrate surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual that affect the execution of work under this specification section.
2. Insure that all flooring has been installed, fitted close to the wall to provide even support to the resilient base, and to insure a tight, smooth fit along the floor.
3. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
4. Execution of work under this specification section shall constitute acceptance of existing conditions.

B. Concrete Subfloors:
1. Verify that concrete slabs comply with ASTMF 710 "Practice for Preparing Concrete Floors to Receive Resilient Flooring."
2. Verify that substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.
3. Verify that subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
4. Evaluate the RH (Relative Humidity) and pH (Alkalinity) for compliance with adhesives and resilient tile manufacturer's written substrate preparation recommendations.

a. If a Vapor-Alkalinity Control System product has been installed to reduce water vapor emission or phosphates thereby negating the RH and pH Test Results, evaluate products for compatibility with adhesives and resilient base products.

5. Determine adhesion characteristics by performing bond tests recommended by the resilient base and accessory manufacturer.

3.2 PREPARATION

A. Coordination:
1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:
1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work.

C. Surface preparation:
1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
2. Wall substrates to receive resilient base must be completely clean, dry, smooth and free of oil, grease, rust, paint, varnish, shellac, or any other foreign substance.
3. From floor substrates, remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that may contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the resilient base and accessory manufacturer.
   a. If a Vapor-Alkalinity Control System has been installed, do not remove this system.
4. Fill all cracks, joints, etc. with a Crack and Joint Filler according to manufacturer's written instructions.
5. Install self-leveling underlayment compound at depressed or uneven floor conditions.
6. Vacuum clean substrates to be covered immediately before installation.
7. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.
8. Proceed only after unsatisfactory conditions have been corrected.
9. Perform manufacturer recommended bond test to verify adhesion of resilient base and accessory to substrate.
10. Apply any recommended primers over the leveling compounds or treated concrete slabs prior to the installation of any resilient base or accessory products if recommended by the manufacturer.

3.3 INSTALLATION

A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.

B. Layout:
1. Lines shall be straight and true.
2. Refer to Floor Pattern Drawing(s) in the Interior Color Schedule for transitions in color.

C. Resilient Base installation:
1. For base installations on primed metal or enameled surfaces, provide manufacturer's written recommended co-adhesive method of installation applied to both surfaces with contact bond adhesive.

2. On dry, absorbent surfaces, the base shall be adhered with manufacturer's written recommended adhesive and firmly pressed to the walls.
3. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
4. Install in lengths as long as possible to minimize seams.
5. Minimize gaps at seams.
6. Align tops of adjacent pieces.
7. Tightly adhere resilient base to substrate throughout length of piece, with base in continuous contact with horizontal and vertical substrates.
8. Do not stretch resilient base during installation.
9. On masonry surfaces, or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
10. Pre-molded Corners: Install pre-molded corners before installing straight pieces.
11. After the installation, remove all excess adhesive before it dries.
12. Allow adhesive to set firm for approximately 24 hours before washing or applying any pressure.

D. Transition installation:

1. Measure and trim to fit transition pieces prior to installing.
2. Use appropriate approved manufacturer written adhesives for each substrate.
3. After installation, immediately remove all excess adhesive before it dries.

3.4 CLEANING

A. Cleaning:

1. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
2. Clean any soiled surfaces immediately.
3. Clean any soiled surfaces at the end of each day, minimum.
4. Finish shall be clean and ready for the application of any additional finishes.
5. In accordance with manufacturer’s written instructions and recommendations.

3.5 PROTECTION

A. Protection from traffic:

1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

END OF SECTION

SECTION 09 65 19 – RESILIENT TILE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all Resilient Tile Floor Covering materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 02 26 00 HAZARDOUS MATERIALS PROCEDURES
4. 03 30 00 CAST-IN-PLACE CONCRETE
5. 06 10 00 ROUGH CARPENTRY
6. 06 41 23 MODULAR CASEWORK
7. 07 18 50 VAPOR-ALKALINITY CONTROL
8. 08 11 00 METAL DOORS AND FRAMES
9. 09 29 00 GYPSUM BOARD
10. 09 65 10 RESILIENT BASE AND ACCESSORIES
11. 10 05 00 MISCELLANEOUS SPECIALTIES
12. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:

1. In accordance with the following standards:
   a. ADAAG Americans with Disabilities Act Accessibilities Guidelines
   b. ASTM American Society of Testing Materials
   c. RFCI The Resilient Floor Covering Institute.

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Product Data.
   a. For each type of resilient tile flooring indicated.
   b. Manufacturer's full color range (including any standard and premium colors).
   c. Design Data for all components, fillers, adhesives, etc.
2. Samples.
   a. Provide 12 inch sample of each color and pattern selected.
3. Quality Assurance/Control Submittals:
   a. Manufacturer's Written Installation Instructions.
   b. Certificates:
      1) Certificate from floor covering installer that all products supplied for installation comply with local regulations in the area where the project is located controlling the use of Volatile Organic Compounds (VOC's).
   c. Statement of Installer's Qualifications.
4. Closeout Submittals in accordance with the following:
   a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.

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b. Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.
c. Warranty in accordance with this specification and Specification Section - WARRANTIES.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Installer Qualifications:
a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project and is competent in techniques required by the manufacturer.
2. Manufacturer/Supplier Qualifications:
a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
a. CBC California Building Code (CBC 11B-302.1)
b. CDPH California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers”

C. Meetings:
1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
a. Coordinate the work with other work being performed.
b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
c. Review delivery, storage, and handling procedures.
d. Review the article titled PROJECT CONDITIONS of this specification section.
e. Review subfloor preparation procedures.
2. Progress: Scheduled by the Contractor during the performance of the work.
a. Review for proper installation of work progress.
b. Identify any installation problems and acceptable corrective measures.
c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:
1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
2. Damaged products will not be accepted.

C. Storage and protection:
1. Products shall be stored in a dry, protected, interior area above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

b. Maintain temperature in the storage space between fifty (50) degrees Fahrenheit and ninety (90) degrees Fahrenheit.
   1) Seven (7) days prior to installation, acclimate products to environmental requirements of the article titled PROJECT CONDITIONS of this specification section, and the Paragraph titled "Environmental Requirements."
c. Do not double stack.

1.6 PROJECT CONDITIONS

A. Environmental requirements:
   1. Temperature: Maintain ambient temperature in space to receive products at sixty-eight (68) degrees Fahrenheit for two (2) days prior, during, and two (2) days minimum following installation.
      a. After this period, maintain a temperature of not less than 55 degrees Fahrenheit.
      b. After installation, at no such time shall the temperature exceed 85 degrees Fahrenheit.
      c. Inform the Owner of ambient temperature requirements for products installed and maintain until Substantial Completion and turn-over of the building or facility to the Owner.

B. Existing Conditions:
   1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
   2. Field Measurements:
      a. Take and be responsible for field measurements as required.
      b. Report any significant differences between field dimensions and drawings to the Architect.

1.7 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written standard warranty:
      a. Luxury Vinyl Tile Twenty (20) Years.

C. Installer's Warranty:
   1. In accordance with the terms of the specification section - WARRANTIES:
   2. Warranty period Five (5) years.

1.8 MAINTENANCE

A. Extra Materials:
   1. Furnish not less than one box for each 50 boxes or fraction thereof, of each class, wearing surface, color, pattern and size of resilient floor tile installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

a. .

2. Luxury Vinyl Tile manufacturer:
   a. MOHAWK GROUP
   b. .
3. Underlayment Compound:
   a. ARDEX INCORPORATED.
   b. Acceptable alternative manufacturers:
      1) CHEMREX
         a) A compatible bonding agent is needed for this product to adhere to the Vapor-Alkalinity Control System and be considered as equivalent.
4. Crack and Joint Filler manufacturer:
   a. ARDEX INCORPORATED.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. General:
   1. Resilient Tile Flooring shall be the product of one manufacturer and shall to the maximum extent possible be of a single lot number.
   2. Resilient Tile Flooring shall be slip resistant by achieving a minimum 0.6 or greater static coefficient of friction as recommended in Appendix A4.5 of the ADAAG by testing per ASTM D 2047 "Test method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine."
      a. Resilient Tile Flooring installed on ramps shall achieve a minimum 0.8 or greater static coefficient of friction as recommended in Appendix A4.5 of the ADAAG by testing per ASTM D 2047 "Test method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine."
   3. Colors and pattern refer to Interior Color Schedule
   4. All Resilient Tile Flooring shall be impervious to water damage.

B. Luxury Vinyl Tile:
   1. Shall comply with ASTM F 1700 "Specification for Solid Vinyl Floor Tile."

2.3 ACCESSORIES

A. Underlayment Compound:
   1. Provide free-flowing, self-leveling, pumpable, cement based compound for applications from 1 inch thick to feathered edges, 4000 psi minimum in accordance with ASTM C 109 "Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens)," modified for air cure only.
      a. ARDEX "K-15."

B. Crack and Joint Filler:

1. Provide low viscosity rigid polyurethane filler, tensile strength of 4,000 psi minimum, in accordance with ASTM D 638 "Test method for Tensile Properties of Plastics."
    a. ARDEX "ARDIFIX."

C. Concrete Primer (if applicable):
1. Nonstaining type as recommended in writing by flooring manufacturer.

D. Adhesives:
1. Adhesive as recommended in writing by resilient tile manufacturer.
2. Compatible with Vapor-Alkalinity Control System, if installed.
3. Shall comply with requirements in the place where the project is located.
4. Shall be water and mildew resistant.
5. Shall bond to non-porous substrate surfaces.

E. Polish (if applicable):
1. Provide manufacturer's written recommended acrylic floor polish, compatible with resilient flooring materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which, affect the execution of work under this specification section.
2. Check sub-floor variation with long straight edge.
3. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
4. Execution of work under this specification section shall constitute acceptance of existing conditions.

B. Concrete Subfloors:
1. Verify that concrete slabs comply with ASTM F 710 "Practice for Preparing Concrete Floors to Receive Resilient Flooring."
2. Verify that substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.
3. Verify that subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
4. Evaluate the RH (Relative Humidity) and pH (Alkalinity) test results for compliance with adhesives and resilient tile manufacturer's written substrate preparation recommendations.
    a. If a Vapor-Alkalinity Control System product has been installed to reduce water vapor emission or phosphates thereby negating the RH and pH Test Results, evaluate products for compatibility with adhesives and resilient tile products.
5. Determine adhesion characteristics by performing bond tests recommended by the resilient tile manufacturer.

3.2 PREPARATION

A. Coordination:
1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:
1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work.

C. Surface preparation:
1. Prepare surface in accordance with manufacturer's written instructions and recommendations.

2. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that may contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the resilient tile manufacturer.
    a. If a Vapor-Alkalinity Control System has been installed, do not remove this system.
3. Fill all cracks, joints, etc. with a Crack and Joint filler according to manufacturer's written instructions.
4. Install self-leveling underlayment compound at depressed or uneven floor conditions.
5. Broom and vacuum clean substrates to be covered immediately before installing resilient tile.
6. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.
7. Proceed with installation only after unsatisfactory conditions have been corrected.
8. Apply any recommended primers over the leveling compounds or treated concrete slabs prior to the installation of any resilient tile products.
9. Concrete (Previous Flooring Material Removed): Remove existing adhesive by grinding with a concrete grinding machine and moist sand. Do not use solvents to remove adhesive.

3.3 INSTALLATION

A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.

B. Layout:
1. Lines shall be straight and true.
2. Refer to Floor Pattern Drawing(s) and the Interior Color Schedule for layout of patterns.

C. Resilient Tile installation:
1. Apply adhesive in accordance with manufacturer's current written recommendations.
    a. Do not apply adhesive too far in advance of the tile installation. Adhesive must be sufficiently "tacky" in accordance with adhesive manufacturer's written recommendations for the proper installation of the tile.
2. Start installation at center line of room, unless indicated otherwise, and work towards the borders.
3. Border tiles shall not be less than half a tile.
4. Scribe, cut, and fit resilient tile flooring to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture, including cabinets, pipes, outlets, edgings, thresholds, and nosing's.
5. Extend resilient tile flooring into toe spaces, door reveals, closets, and similar openings.
6. Installation shall be true, level, and even with tight joints.
7. Check work to see that all tile are lying down and setting in.
8. Maintain reference markers, holes or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-permanent marking device.

3.4 CLEANING

A. Cleaning:
1. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
2. Clean any soiled surfaces immediately.
3. Clean any soiled surfaces at the end of each day, minimum.
4. Finish shall be clean and ready for the application of any additional finishes.
5. In accordance with manufacturer's written instructions and recommendations.

3.5 DEMONSTRATION

A. In accordance with Specification Section – PROJECT CLOSEOUT.

1. Provide the services of a manufacturer-authorized service representative to demonstrate and train Owner's maintenance personnel as specified below.
   a. Train Owner's maintenance personnel on cleaning procedures and schedules related to cleaning and preventative maintenance,
   b. Schedule training with the Owner's maintenance personnel with at least seven (7) days advance notice.

3.6 PROTECTION

A. Protection from traffic:

1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

3.7 SCHEDULES

A.

B. Luxury Vinyl Tile **RT-1 .**

1. Manufacturer: MOHAWK GROUP.
2. Product Name: Living Local Collection, Premium Wood
3. Physical Characteristics:
   a. Wearing Surface: Smooth.
   b. Classification of Composition per ASTM F 1700 "Specification for Solid Vinyl Floor Tile":
      1) Class III.
   c. Overall Thickness: 2.5mm
   d. Wear Layer: 20 mil
   e. Tile Size: 7.75” x 52”
   f. Static Load Limit per ASTM F 970 "Test method for Static Load Limit":
      1) 1000 psi.
4. Performance Characteristics:
   a. Critical Radiant Flux per ASTM E 648 "Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source":
      1) Class 1, not less than 0.45 W/sq.cm.
   b. Smoke Density per ASTM E 662 "Test method for Specific Optical Density of Smoke Generated by Solid Materials":
      1) Less than 450.

END OF SECTION

SECTION 09 67 23 – RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 03 30 00 CAST-IN-PLACE CONCRETE
   4. 05 12 00 STEEL AND FABRICATIONS
   5. 06 22 00 MILLWORK
   6. 07 18 50 VAPOR-ALKALINITY CONTROL
   7. 08 70 00 HARDWARE
   8. 09 29 00 GYPSUM BOARD
   9. 09 77 00 RESINOUS WALL COVERING
   10. 09 91 00 PAINTING
   11. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with the following standards:
      a. ISO International Organization for Standardization

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product Data.
      a. Submit technical data, installation instructions, and general recommendations for each resinous flooring material required.
      b. Submit manufacturer's full color range (including any standard, premium and custom colors) for selection by the Architect.
         1) For initial selection of colors and finishes for consideration, submit manufacturer's color charts showing full range of colors and finishes available.
   2. Samples.
      a. Provide 4-inch square sample of each type applied to a rigid backing, in color, finish, and texture as selected.
   3. Quality Assurance/Control Submittals:
      a. Manufacturer / Supplier Qualifications.
      b. Installer Qualifications and Certifications.
      c. Certificates:
         1) Submit three (3) copies of certificates.
         2) Include ISO 9002 certification indicating that all materials, including primers, resins, curing agents, finish coats, aggregates and sealants are manufactured and tested as a registered quality system.
      d. Manufacturer's written Instructions:
         1) Submit three (3) copies of manufacturer's written instructions.
   4. Closeout Submittals in accordance with the following:

a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
b. Warranty in accordance with Specification Section - WARRANTIES.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer/Supplier Qualifications:
a. Single Source Responsibility: Obtain primary resinous flooring materials including vapor barrier, primers, resins, hardening agents, finish or sealing coats from a single source manufacturer with not less than ten (10) years of successful experience in manufacturing and installing principal materials described within this section.
b. Provide secondary materials only of type and from source recommended in writing by manufacturer of primary materials.
c. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
2. Installer Qualifications:
a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
b. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
a. CBC California Building Code (CBC 11B-302.1).

C. Meetings:
1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
2. Progress: Scheduled by the Contractor during the performance of the work.
a. Review for proper installation of work progress.
b. Identify any installation problems and acceptable corrective measures.
c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
1. Products shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on-site mixing errors. No on-site weighing or volumetric measurements will be allowed.
2. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:
1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
2. Damaged products will not be accepted.

C. Storage and protection:
1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.

a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

2. Temperature of storage area shall be maintained between 60 and 85 degrees F.

1.6 PROJECT CONDITIONS

A. Environmental requirements:

1. Temperature: Maintain ambient temperature in space to receive products between sixty (60) degrees Fahrenheit and eighty-five (85) degrees Fahrenheit for seven (7) days prior, during, and seven (7) days minimum following installation. Inform the Owner of ambient temperature requirements for products installed and maintain until Substantial Completion and turn-over of the building or facility to the Owner.

B. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Concrete substrate shall be properly cured for a minimum of 30 days.
3. RH (Relative Humidity) and Alkalinity Test:
   a. Shall control vapor transmission up to and including 100 percent readings per RH Testing of ASTM F 2170 "Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes."
   b. Shall control alkalinity for a long-term maximum resistance of pH 14 per pH Testing of ASTM F 710 "Preparing Concrete Floors to Receive Resilient Flooring."
4. Job area to be free of other trades during floor installation.

1.7 WARRANTY

A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:

1. In accordance with manufacturer's written standard warranty:
   a. Warranty Period One (1) Year.

C. Installer's Warranty:

1. In accordance with the terms of the Specification Section - WARRANTIES:
   a. Warranty period [One (1) Year.][Five (5) years.]

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified Membrane (Moisture Control System) product manufacturers:
   a. STONHARD, INC. "MVT."
   b. Acceptable alternative manufacturers:
      1) SHERWIN WILLIAMS HIGH PERFORMANCE FLOORING "RESUFLOR AQUA MCS."
2. Specified Epoxy Resinous Flooring product manufacturers:
   a. STONHARD, INC. "STONSHIELD HRI."

b. Acceptable alternative manufacturers:
1) SHERWIN WILLIAMS HIGH PERFORMANCE FLOORING "RESUFLOR SCREED DECO QUARTZ."

3. Specified Urethane Resinous Flooring product manufacturers:
a. STONHARD, INC. "STONSHIELD URI."
b. Acceptable alternative manufacturers:
1) SHERWIN WILLIAMS HIGH PERFORMANCE FLOORING "FASTOP TOPFLOOR-U1."

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Membrane (Moisture Control System):
1. Two-component, high-solids, epoxy system designed to suppress excess moisture in concrete prior to an overlayment.
2. Physical Properties:
a. Thickness: 15-16 mils.
b. Tensile Strength (ASTM D 638) 4,400 psi.
c. Percent Elongation (ASTM D 638) 12%.

B. Epoxy Resinous Flooring: **RF-1**:
1. System Components:
a. Epoxy Primer.
b. Epoxy Mortar Base.
c. Epoxy Undercoat.
d. Quartz aggregate broadcast media.
e. Epoxy Sealer.
2. Overall thickness: approximately 3/16".
3. Physical Properties: Provide flooring system in which physical properties of topping including aggregate, when tested in accordance with standards or procedures referenced below, are as follows:
a. Compressive Strength (after 7 days): 10,000 psi.
1) Per ASTM C 579 "Test methods for Compressive Strength of Chemical Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes."
b. Tensile Strength: 2,000 psi.
1) Per ASTM C 307 "Test Method for Tensile Strength of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings."
c. Flexural Strength: 4,300 psi.
1) Per ASTM C 580 "Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes."
d. Flexural Modulus of Elasticity: 2.0 x 10^6 psi.
1) Per ASTM C 580 "Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes."
e. Hardness (Shore D Durometer): 85-90.
1) Per ASTM D 2240 "Standard Test Method for Rubber Property – Durometer Hardness."
f. Bond Strength (100 percent concrete failure): 400 psi.
1) Per ASTM D 4541 "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers."
g. Impact Resistant: 160 in.lbs.
1) Per ASTM D 4226 "Test Methods for Impact Resistant of Rigid Poly Vinyl Chloride (PVC) Building Products."
h. Abrasion Resistance (CS-17 wheel): 0.06 gm max weight loss.

1) Per ASTM D 4060 "Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser."

i. Flammability (extent of burning 0.25 inches max): Class I.
1) Per ASTM D 635 "Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position."

j. Thermal Coefficient of Linear Expansion: 1.3 x 10-5 in/inoC.
1) Per ASTM C 531 "Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings and Polymer Concretes."

k. Water Absorption: 0.1 percent.
1) Per ASTM C 413 "Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes."

l. Heat Resistant Limitation:
1) For continuous exposure: 140 deg. F.
2) For intermittent spills: 200 deg. F.

m. Cure Rate Allowance (at 77 deg. F, 24 hours for normal operations): 12 hours for foot traffic.

n. VOC Content: Not to exceed 40 grams per liter.

C. Urethane Resinous Flooring: **RF-2:**

1. System Components:
a. Urethane mortar.
b. Quartz aggregate broadcast media.
c. Polyaspartic urethane undercoat.
d. Quartz aggregate broadcast media.
e. Polyaspartic urtehane sealer.

2. Overall thickness: approximately 3/16" - 1/4".

3. Physical Properties: Provide flooring system in which physical properties of topping including aggregate, when tested in accordance with standards or procedures referenced below, are as follows:
a. Compressive Strength (after 7 days): 5,000 psi.
1) Per ASTM C 579 "Test methods for Compressive Strength of Chemical Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes."

b. Tensile Strength: 1,000 psi.
1) Per ASTM C 307 "Test Method for Tensile Strength of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings."

c. Flexural Strength: 2,000 psi.
1) Per ASTM C 580 "Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes".

d. Flexural Modulus of Elasticity: 1.1 x 10^6 psi.
1) Per ASTM C 580 "Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes."

e. Hardness (Shore D Durometer): 80-84.
1) Per ASTM D 2240 "Standard Test Method for Rubber Property – Durometer Hardness."

f. Bond Strength (100 percent concrete failure): 400 psi.
1) Per ASTM D 4541 "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers".

g. Impact Resistant: 160 in.lbs.
1) Per ASTM D 4226 "Test Methods for Impact Resistant of Rigid Poly Vinyl Chloride (PVC) Building Products."

h. Abrasion Resistance (CS-17 wheel): 0.06 gm max weight loss.

1) Per ASTM D 4060 "Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser."

i. Flammability (extent of burning 0.25 inches max): Class I.
1) Per ASTM D 635 "Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position."

j. Thermal Coefficient of Linear Expansion: 1.3 x 10-5 in/in deg. F.
1) Per ASTM C 531 "Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings and Polymer Concretes."

k. Water Absorption: 0.01 percent.
1) Per ASTM C 413 "Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes."

l. Heat Resistant Limitation:
1) For continuous exposure: 200 deg. F.
2) For intermittent spills: 250 deg. F.

m. Cure Rate Allowance (at 77 deg. F, 24 hours for normal operations): 6 hours for foot traffic.

2.3 ACCESSORIES

A. Joint Sealant Materials:
1. Manufacturer's compatible joint sealant materials in compliance with standards specified within Specification Section – SEALANTS.
a. STONHARD, INC. STONFLEX MP7.
b. Acceptable alternative manufacturers:
1) SHERWIN WILLIAMS HIGH PERFORMANCE FLOORING: As recommended in writing by manufacturer, compatible with floor product.

B. Metal Trim:
1. Manufacturer's standard metal trim (cove strip), for terminating cove base.
2. Acceptable alternative manufacturers:
a. General Polymers: As recommended in writing by manufacturer, compatible with floor product.

2.4 FINISHES

A. Color as selected by the Architect from manufacturer's standard colors.

B. Surface Texture:
1. General:
a. Application Method: Texture is broadcast into first application of Finish Coat by means of Spraycaster to refusal.
b. Number of Applications: One.
c. Provide smooth finish at areas under equipment.
d. Coefficient of Friction per ASTM D 2047 "Test method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine":
1) Standard Texture: 0.8.
2) Medium Texture: 0.7.

C. Textures: Provide appropriate texture as recommended in writing by the manufacturer.
1. T-1: Texture that is appropriate for Restroom applications, unless otherwise noted.
2. T-2: Texture that is appropriate for Kitchen applications. Provide smooth finish at areas under kitchen equipment.
3. T-3: Texture that is appropriate for Shower applications, unless otherwise noted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which, affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:
   1. Protect all adjacent surfaces from drips, spray, air pollution of the surrounding environment, and other damage from work under this specification section.

C. Surface preparation:
   1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
   2. Concrete subfloor shall be dry in accordance with RH and Alkalinity tests, as tested in accordance with Specification Section – VAPOR-ALKALINITY CONTROL.
   3. Chipping around existing floor drains & floor sinks shall be in accordance with coating manufacturer's written recommendations for proper interface of resinous flooring so there is no standing water around drains after the resinous flooring system is applied.
   4. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.
   5. Comply with requirements in SSPC-SP 13/NACE No. 6, with a Concrete Surface Profile of 3 or greater in accordance with ICRI Technical Guideline No. 310.2R, unless manufacturer's written instructions are more stringent.
   6. Control Joints:
      a. After floor is blasted/prepared, pre-fill the joints with STONSET PM5 (or SHERWIN WILLIAMS HIGH PERFORMANCE FLOORING equivalent) epoxy patching mortar.
   7. Expansion Joints:
      a. Mark expansion joint widths on walls where proposed base would cover the marks so that one can find them again after the floor is applied.

3.3 APPLICATION

A. General:
   1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
   2. In accordance with approved submittals.
   3. In accordance with Regulatory Requirements.
   4. Set plumb, level, and square.

B. Layout:
   1. Lines shall be straight and true.

C. Application:
   1. Apply osmotic resistant grout to all slabs.
      a. Troweled Mortar: Mix mortar material according to manufacturer's written recommended procedures.
         1) Primer: Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates.
            a) Coordinate timing of primer application with application of troweled mortar to ensure optimum adhesion between resinous flooring materials and substrate

2) Apply immediately after mixing.
3) Pour a bead of material and rake out with a 1/2" x 1/2" V-notched rake.
4) Apply the material at a thickness of 1/8".
5) Roll the material with a spiked roller to release any entrained air and produce a smooth finish layer.
6) Keep a wet edge so that each subsequent mix may be knit into the previous mix within a 20 minute period.
7) Allow to cure for 24 hours in accordance with manufacturer's written recommendations.
8) Prepare the membrane surface after curing by shot blasting to ensure proper adhesion. Edges and confined spaces must be ground with a diamond cup-stone. Once prepared, treat the membrane like a concrete surface.

2. Apply cove base and terminate to cove strip at +5" above finished floor for both coating types.

D. Epoxy Resinous Flooring application:
1. Primer: Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates.
a. Coordinate timing of primer application with application of Resinous Flooring to ensure optimum adhesion between resinous flooring materials and substrate.
2. Mix Epoxy Resinous Flooring and then screed apply and trowel to a tightly closed finish.
3. Allow for at least an 8 hour cure.
4. Lightly grind the mortar base.
5. Mix and apply the undercoat to the floor surface using a steel squeegee, followed by rolling with a looped roller.
6. Immediately broadcast aggregate using manufacturer's written recommended equipment and techniques into the freshly applied undercoat.
7. Allow at least 8 hours (or longer depending on manufacturers recommendations) to cure between coats.
8. Scrape and sweep the floor to remove all loose aggregate particles, then vacuum.
9. Mix and apply sealer with strict adherence to manufacturer's installation procedures, and the texture type selected by the Architect.
10. Allow the sealer to cure in accordance with the manufacturer's written recommendations.

E. Urethane Resinous Flooring application:
1. Follow the detailed manufacturer's printed instructions mixing and applying Urethane Resinous Flooring.
2. Material shall be used immediately after mixing.
3. A "Screed Applicator" shall be used to distribute the mixed Resinous Flooring onto the floor.
4. Notched finishing trowels and spiked rollers as recommended in writing by the manufacturer shall be used to smooth the surface of the material to the required thickness.
5. Texture aggregate shall then be broadcast into the wet mortar, in texture finish as selected by the Architect.
6. Allow to cure 6 – 8 hours and apply sealer coat.

F. Expansion Joints:
1. Once the floor has been applied and has cured, find the Expansion Joint marks on the wall and saw cut to the width of the joint and fill with STONFLEX PM7 (or SHERWIN WILLIAMS HIGH PERFORMANCE FLOORING equivalent).

3.4 FIELD QUALITY CONTROL

A. Site Tests:
1. As required by Regulatory Requirements.
2. RH and Alkalinity Tests – see Specification Section – VAPOR-ALKALINITY CONTROL.
3. The right is reserved to invoke the following material testing procedure at any time, and any number of times during the period of flooring installation:

a. The Owner will engage the service of an independent testing laboratory to sample materials being used on the job site. Samples of material will be taken, identified and sealed, and certified in the presence of the Contractor.
   1) Testing laboratory will perform tests for any of the characteristics specified, using applicable testing procedures referenced herein, or if none referenced, in manufacturer's product data.
   2) If test results show materials being used do not comply with specified requirements, the Contractor may be directed by the Owner to stop work; remove non-complying materials; pay for re-testing; re-apply flooring materials to properly prepared surfaces which had previously been coated with unacceptable materials until the work is right.

4. Floor Thickness Verification:
   a. At the owner's discretion and under his supervision, the contractor shall take plus or minus 1" random cores per 1,000 sq. ft. through the system into the substrate to verify proper system thickness. Cored areas less than specified thickness shall be removed and replaced or increased in thickness by the installing contractor, in a manner that does not affect the performance or integrity of the system. Cored areas which comply with the written recommended system thickness shall be built up to match the surrounding surface elevation prior to applying the seal coat(s). Cores taken and patched will be noticeable, therefore, cores should be taken from areas where aesthetics are less critical

B. Inspection:
   1. As required by Regulatory Requirements.
   2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
   3. No work shall be without the inspections required by Regulatory Requirements.

3.5 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
   1. Clean any soiled surfaces immediately using cleaning materials and procedures recommended in writing by resinous flooring manufacturer.
   2. DO NOT clean the epoxy floors for a period of seven (7) days after installation in order to allow proper curing of the epoxy floor systems for full resistance to chemicals.

3.6 PROTECTION

A. Protection from traffic:
   1. Job area to be free of other trades for a period of twenty-four (24) hours after floor installation.
   2. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's written recommendations for protective materials and method of application.
   3. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

END OF SECTION

SECTION 09 72 00 - WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all materials, labor, equipment and services necessary to furnish and install all Wall Coverings, accessories, and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.
      a. FRP Panel systems.
      b. Vinyl Covered Tackboard Panel systems.
      c. Vinyl Wall Covering systems.
      d. Acoustical Wall Board systems.
      e. Acoustical Panel systems.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 06 41 23 MODULAR CASEWORK
   4. 09 24 00 CEMENT PLASTER
   5. 09 29 00 GYPSUM BOARD
   6. 09 50 00 ACOUSTICAL CEILINGS
   7. 09 65 10 RESILIENT BASE AND ACCESSORIES
   8. 10 11 00 VISUAL DISPLAY BOARDS
   9. 10 26 00 WALL AND CORNER GUARDS
   10. 10 28 13 TOILET ACCESSORIES
   11. 10 44 00 FIRE PROTECTION SPECIALTIES
   12. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product Data.
      a. Submit manufacturer's full color range (including any standard, premium and custom colors) of all Wall Coverings for selection by the Architect.
   2. Samples.
      a. Provide 6 inch square sample of each Wall Covering product for color and pattern selected.
      b. Provide 6 inch lineal samples of each Wall Covering trim material specified.
      c. Custom Graphic Vinyl Wall Covering samples:
         1) Submit one reduced scale color proof showing the overall image of each mural for approval prior to manufacture.
         2) Submit 24" x 24" min. ground full strike-off at full scale of each mural design for approval prior to manufacture.
         3) Submit memo size samples cut from current production of ground wall covering selected to demonstrate quality, weight and embossing.
   3. Closeout Submittals in accordance with the following:
      a. Warranty in accordance with Specification Section - WARRANTIES.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications:
    a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
    b. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
2. Manufacturer/Supplier Qualifications:
    a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    a. CBC California Building Code (CBC 803).

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
1. Products shall be individually wrapped.
2. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:
1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
2. Damaged products will not be accepted.

C. Storage and protection:
1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
    a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.5 PROJECT CONDITIONS

A. Environmental requirements:
1. Temperature: Maintain ambient temperature in space to receive products between sixty (60) degrees Fahrenheit and eighty (80) degrees Fahrenheit for three (3) days prior, during, and three (3) days minimum following installation. Inform the Owner of ambient temperature requirements for products installed and maintain until Substantial Completion and turn-over of the building or facility to the Owner.

B. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

1.6 SCHEDULING

A. Custom Graphic Wallcovering: Verify lead time with manufacturer. Assume no less than six week lead time from approved submittals.

1.7 WARRANTY

A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written standard warranty:
      a. Warranty Period One (1) Year.

C. Installer's Warranty:
   1. In accordance with the terms of the Specification Section - WARRANTIES:
      a. Warranty period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
   1. Specified FRP Panel product manufacturer:
      a. CRANE COMPOSITES "Sequentia" with NUDO Trim Accessories.
      b. Acceptable alternative manufacturers:
         1) BP CHEMICALS with NUDO Trim Accessories.
         2) MARLITE with NUDO Trim Accessories.
         3) NUDO PRODUCTS, INC. with NUDO Trim Accessories.
   2. Specified Vinyl Covered Tackboard product manufacturer, as distributed through WESTERN BUILDING MATERIALS.:
      a. Panel: CHATFIELD-CLARKE COMPANY, INC.
      b. Face Material: KOROSEAL WALLCOVERINGS,
      c. Acceptable alternative manufacturers:
         1) KOROSEAL SCHOOL COLLECTION as manufactured by KOROSEAL WALLCOVERINGS.
         2) LAMVIN INC.
   3. Specified Custom Graphic Vinyl Wall Covering product manufacturer:
      a. MDC WALL “Digital Imaging”
      b. KOROSEAL INTERIOR PRODUCTS LLC. "Digital Lab"

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. FRP Panels:
   1. Width 48 inches.
   2. Thickness 0.090 inches.
   3. Fire Rating per ASTM E 84 "Standard Test Method for Surface Burning Characteristics of Building Materials": Class C.
      a. Flame Spread Maximum 175.
      b. Smoke Developed Maximum 270.
   4. Finish: Pebble finish.
   5. Color: As selected from manufacturer's standard, premium, and custom color palette.
   6. Accessories:
      a. Adhesive as recommended in writing by manufacturer that meets the requirements of the place where the Project is located.
      b. Sealant.
         1) Set all perimeter J-Mold trim in a continuous bead of silicon sealant.

7. Trim:
   a. Provide inside, , division and edge trim moldings as required for the conditions present in the project.
   b. Material: Aluminum.
   c. Lengths 96 inches
   d. Thickness 0.090 inch
   e. Trim Shapes:
      1) J-Mold NUDO A-28.
      2) Divider NUDO A-30.
      3) Inside Corners NUDO A-32.
   f. Finish: Powder Coated in colors to match the field color of the FRP Panels.
8. Outside Corner Trim:
   a. Provide outside trim moldings as required
   b. Material: Stainless Steel, Type 316, 24 gauge
   c. Lengths: 96 inches
   d. Trim Shape
      1) Outside Corner Guard OC-1108
   e. Finish: No. 4 Brushed

B. Vinyl Covered Tackboard:
1. Tackboard Size: 1/2" x 48" wide by maximum practical height to minimize joints.
   a. Wood fiber substrate tackboard shall be 1/2" thick, cellulose fiberboard sheathing, beveled side edges and square end edges, in accordance with ASTM C 208 "Specification for Cellulosic Fiber Insulating Board," complying with the minimum standards listed below:
      1) Weight, lb/1000 ft^2 640.
      2) Transverse strength, lbf 14.5.
      3) Tensil Strength, lb/in^2 242.
      4) MOR, lb/in^2 380.
      5) "k" Factor 0.37.
      6) Maximum Flame Spread - Class B 75.
      7) Maximum Smoke Developed - Class B 175.
2. Finish: Refer to Interior Color Schedule
   a. All vinyls used are to be 15 oz. total weight per lineal yard (Type I) with a cloth backer to insure consistent emboss.
      1) Class A vinyls shall be tested in accordance with ASTM E 84 "Standard Test Method for Surface Burning Characteristics of Building Materials," with the following maximum requirements:
         a) Maximum Flame Spread - Class A 25.
         b) Maximum Smoke Developed - Class A 5.
3. Edge:
   a. Beveled, long side edges with vinyl wrapped to back side. Short end edges to be square cut with vinyl flush with end of substrate board.
4. Accessories:
   a. Provide vinyl covered PVC moldings in the following configurations: edge, inside and outside corner, and intermediate splice moldings. Provide colors to match the field panels. Use of moldings and locations shall be indicated on the drawings.
5. Overall panel when wrapped with Class A vinyls shall meet flame spread and smoke developed index approval in accordance with ASTM E 84 "Standard Test Method for Surface Burning Characteristics of Building Materials," as follows:
   a. Maximum Flame Spread - Class B 75.
   b. Maximum Smoke Developed - Class B 175.
6. Adhesive:
   a. In accordance with tackboard panel manufacturer's written recommendations, and in compliance with VOC requirements.

C. Vinyl Wallcoverings:
1. Custom Graphic Wallcovering:
a. Digital Image: Owner/Architect to provide PDF file of image.
b. Type: Type II.
c. Size: 54 inches wide.
d. Total Weight: 21 oz. per linear yard.
1) Fabric Weight 2.7 oz. per linear yard.
2) Vinyl Weight 18.3 oz. per linear yard.
3) Vinyl Gage 9 mils.
e. Fabric Backing "Osnaburg".
f. Ground: "Fine Texture SMSDCDS01031".
g. Wallcovering Options:
1) "Early Warning Effect" formulation warning of impending fire before flames develop.
2) Formulation releases a colorless, odorless vapor which automatically activates ionization smoke detectors.
3) Standard top coating for cleanability and UV protection.
h. Flame Spread: Maximum 15.
1) In accordance with ASTM E 84 Tunnel Test.
i. Smoke Development: Maximum 20.
1) In accordance with ASTM E 84 Tunnel Test.
j. Accessories:
1) Adhesives: manufacturer's clear strippable wall covering adhesive recommended, "Koroseal A-848-B" Heavy Duty Premixed Vinyl adhesive, or approved equivalent.
2) Substrate primer/sealer compatible with GYPSUM BOARD: white pigmented alkyd or acrylic/latex base primer specially for use with vinyl wallcoverings.
3) Trim – Termination Fry-Reglet WCTBT125-217. Refer to Interior Elevation for location and Detail.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual, which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION
A. Coordination:
1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
B. Protection:
1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
C. Surface preparation:

1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

3.3 INSTALLATION

A. General:
   1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
   2. In accordance with approved submittals.
   3. In accordance with Regulatory Requirements.
   4. Set plumb, level, and square.

B. Layout:
   1. Lines shall be straight and true.

3.4 INSTALLATION OF FRP PANELS

A. Install panels in a full spread of adhesive.
B. Install factory-laminated panels using concealed mounting splines in panel joints.
C. Install trim accessories with adhesive. Do not fasten through panels.
D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

3.5 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
   1. Clean any soiled surfaces immediately.
   2. Finish shall be clean and ready for the application of any additional finishes.
   3. In accordance with manufacturer's written instructions and recommendations.

END OF SECTION

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SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to furnish and install Painting, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.

2. Material and Equipment to be Painted: Paint all piping, unwrapped ductwork, electric conduits exposed to view. Prime and paint all factory finished mechanical and electrical equipment and accessories exposed to view.

3. Material and Equipment not to be Painted: Do not paint piping, ductwork, equipment and machinery located in attic spaces, above furred or suspended ceilings, in furred pipe or duct spaces. Do not paint factory finished equipment or machinery located in mechanical rooms or mechanical buildings, attics, furred or suspended ceilings.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

1. DIVISION 00 SPECIFICATION SECTIONS.

2. DIVISION 01 SPECIFICATION SECTIONS.

3. 04 21 30 THIN BRICK VENEER
4. 04 22 00 CONCRETE MASONRY UNITS
5. 04 23 00 GLASS UNIT MASONRY
6. 05 12 00 STEEL AND FABRICATIONS
7. 05 30 00 METAL DECK
8. 06 22 00 MILLWORK
9. 06 41 23 MODULAR CASEWORK
10. 07 40 00 METAL PANELS
11. 07 60 00 SHEET METAL
12. 07 72 00 ROOF ACCESSORIES
13. 07 92 00 SEALANTS
14. 08 11 00 METAL DOORS AND FRAMES
15. 08 14 16 WOOD DOORS
16. 08 31 13 ACCESS DOORS AND FRAMES
17. 08 33 00 COILING DOORS
18. 08 51 23 STEEL WINDOWS
19. 08 70 00 HARDWARE
20. 08 80 00 GLASS
21. 09 24 00 CEMENT PLASTER
22. 09 29 00 GYPSUM BOARD
23. 09 50 00 ACOUSTICAL CEILINGS
24. 09 64 29 HARDWOOD FLOOR
25. 09 64 66 RESILIENT WOOD FLOOR
26. 09 65 10 RESILIENT BASE AND ACCESSORIES
27. 09 67 23 RESINOUS FLOORING
28. 10 05 00 MISCELLANEOUS SPECIALTIES
29. 10 21 13 TOILET PARTITIONS
30. 10 26 00 WALL AND CORNER GUARDS
31. 10 44 00 FIRE PROTECTION SPECIALTIES
32. 32 12 00 PAVEMENT

33. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:
1. In accordance with the following standards:
a. MPI Master Painters Institute
1) MPI - Architectural Painting Specification Manual.
2) MPI – Maintenance Repainting Manual.
a) MPI RSP Master Painters Institute Repaint Surface Preparation Standards, Chapter 6, Section 2.
3) MPI – Glossary.
b. PDCA Painting and Decorating Contractors of America, latest edition of the Architectural Specification Manual, as prepared by Specification Services, Inc., Washington State Council of the PDCA.

1.3 DEFINITIONS

A. The following definitions are just some of the more important definitions used within this section, and were taken from the MPI Glossary Manual, or used to simplify language used by the Architect. These definitions and others stated within the Manual apply for this Specification Section.

1.	Acrylic Latex	An aqueous dispersion of acrylic resins.
2.	Acrylic Resin	A/R - Synthetic resins made by polymerizing esters of acrylic acid.
3.	A/U	Aliphatic Urethane
4.	A/A/U	Aliphatic Acrylic Urethane
5.	Blocking	Sticking or bonding together of two painted surfaces that are in direct contact. Most often caused by stacking painted articles before dry or reaching a "block free" (or "non-blocking") stage.
6.	DFT	Dry Film Thickness – the depth or thickness of a coating in the dry state. Expressed in mils (1/1000 inch) or microns.
7.	DRY FALL	A Fog Paint designed to be applied by spray and dries fast enough that the overspray will be a dry powder after falling a certain distance. The dust can then be swept or vacuumed up.
8.	ODFT	"Overall Dry Film Thickness" – the depth or thickness of a complete coating system in the dry state. Expressed in mils (1/1000 inch) or microns.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
1. Product Data.
a. Submit manufacturer's full color range, including standard, premium and custom colors, for selection by the Architect.
b. Material Safety Data Sheets will be turned over to the Owner in compliance with local rules and regulations, but will not be reviewed.
c. Materials List: Format in accordance with Paint Finish Schedule.
d. Additional submittals to substantiate proposed equivalent systems.
2. Samples.
a. Brushouts: In accordance with Specification Section - SUBMITTAL PROCEDURES.

b. For each color and finish selected provide paint brushouts showing color tint graduation of each coat to and including the final color coat.
   1) Selected colors and finishes:
      a) Size: 8 1/2" x 11" boards.
      b) Quantity: 3 boards of each color and finish.
      c) Board material wherever possible and for transparent finishes shall be same as material to be finished. Opaque finishes may be on heavy card stock.

3. Closeout Submittals in accordance with the following:
   a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
   b. Project Documents in accordance with Specification Section - PROJECT DOCUMENTS.
   c. Warranty in accordance with Specification Section - WARRANTIES.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Material Qualifications:
      a. Where possible (except for specified materials), paint materials shall be products of only one manufacturer.
      b. All materials, preparation and workmanship shall conform to requirements of the specified edition of the Architectural Painting Specification Manual by the Master Painters Institute (hereafter referred to as the MPI Painting Manual), unless otherwise indicated.
      c. Flame Spread Ratings in accordance with ASTM E 84 "Standard Test Method for Surface Burning Characteristics of Building Materials":
         1) Paint finishes in required exit stairways, corridors and exitways must meet flame spread ratings as required by regulatory agencies.
         2) Class A - Tunnel Test 0-25 for enclosed required exit stairways and other exit ways.
         3) No interior paint or wall finish will be permitted having a tunnel test in excess of 200. All paint materials must be certified that materials meet these requirements.
      d. Manufacturer's Written Instructions - One for the Architect, Contractor and the Owner:
         1) Submit three (3) copies of manufacturer's written instructions.
      e. Compatibility:
         1) Paint materials and equipment shall be compatible in use.
         2) Finish coats shall be compatible with prime coat.
         3) Prime coats shall be compatible with surface to be coated.
         4) Tools and materials shall be compatible with coating to be applied.
      f. Air Quality:
         1) Paint materials and equipment used for application will comply with CARB Air Quality Control Standards in effect at the Project Site and at the time of application.
   2. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
         1) Only qualified journeypersons, as defined by local jurisdiction, shall be engaged in painting and decorating work. Apprentices may be employed

provided they work under the direct supervision of a qualified journeyperson in accordance with trade regulations.

3. Manufacturer/Supplier Qualifications:
   a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
   a. CA-CHPS California High Performance Schools
   b. CAL/OSHA California/Occupational Safety and Health Act
   c. SCAQMD South Coast Air Quality Management District, Rule 1168.

C. Mockups: Provide a full-coat benchmark finish sample for each type of coating and substrate required for Architect's review. Duplicate finish of approved sample Submittals.
1. Wall Finishes shall be at least 100 sq. ft., suitably marked "MOCKUPS" and protected for the duration of the construction Project.
2. Small areas and items can be selected by the Contractor, suitably marked "MOCKUPS" and protected for the duration of the construction Project.
3. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
4. Approved mockups (wall areas and small areas or items) may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Meetings:
1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
   a. Coordinate the work with all other related work.
   b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
   a. Review for proper installation of work progress.
   b. Identify any installation problems and acceptable corrective measures.
   c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
   a. Inspect and identify any problems that may impede issuance of warranties and guaranties.
   b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site:
1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
2. Damaged products will not be accepted.

B. Storage and protection:
1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units, in a locked, clean and neat, well ventilated area.
   a. All receiving, opening and mixing shall be done in this area.

b. Oily rags and waste shall be removed from area each night and all other precautions shall be taken to avoid danger of fire.
c. Empty containers shall not be removed from site, unless otherwise approved by the Architect.
d. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.7 PROJECT CONDITIONS

A. Environmental requirements:
1. Rain or Fog:
a. No work under this section shall be started or maintained under threat of rain.
b. Surfaces shall be painted only when they are free from moisture.
c. No painting of exterior surfaces shall be done less than 72 hours of actual drying weather after a rain or during periods of dew or fog.
d. Perform no painting or decorating work when the maximum moisture content of the substrate exceeds:
1) 12 percent for concrete and masonry (clay and concrete brick / block).
2) 15 percent for wood.
3) 12 percent for plaster and gypsum board.
e. Perform no painting or decorating work when the relative humidity is above 85 percent or when the dew point is less than 5 degrees F variance between the air / substrate temperature.
2. Temperature: No painting shall be done when ambient air and substrate temperatures are below 50 degrees F.
3. Alkalinity: An alkali level of between 7.0 and 8.5 pH is suitable for painting. Any reading above that level, then the surface shall be neutralized as required for the surface to be painted.
a. Methods shall be consistent with MPI - Architectural Painting Specification Manual, and shall not result in any adverse condition causing inadequate adhesion, improper curing and drying, or durability of paint system.
4. No exterior painting shall be done during winds or dusty conditions.
5. Perform no exterior painting and decorating work unless environmental conditions are within MPI and paint manufacturer's requirements or until adequate weather protection is provided.
a. Where required to meet project schedules, suitable weatherproof covering and sufficient heating facilities shall be in place to maintain minimum ambient air and substrate temperatures for 24 hours before, during and after paint application.
6. Perform no interior painting or decorating work unless adequate continuous ventilation and sufficient heating facilities are in place to maintain minimum ambient air and substrate temperatures above minimum requirements for 24 hours before, during and after paint application.
a. Where required to meet project schedules, provide supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

B. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

2. Concrete and masonry surfaces shall be installed at least 28 days prior to painting and decorating work and shall be visually dry on both sides.
3. Conduct all moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple cover patch test.
4. Test concrete, masonry and plaster surfaces for alkalinity as required.
5. Contractor shall provide a minimum lighting level of 323 Lux (30 foot candles) on surfaces to be painted or decorated.

1.8 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.
      a. Original adherence of all materials and no evidence of any surface defect shall be maintained during warranty period.
      b. Color at end of warranty period shall remain free from serious fading and any discernible variations shall be uniform.

B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written standard warranty:
   2. Provide Paint Manufacturer's special ten (10) year Material Warranty co-endorsed by the installer for exterior paint application of cement plaster surfaces.
      a. Warranty period: Ten (10) Years.
   3. Provide Water-Repellent Manufacturer's special Weatherproofing Warranty co-endorsed by the installer for exterior sealer application of concrete or concrete block surfaces.
      a. Warranty period: Ten (10) Years.

C. Installer's Warranty:
   1. Paint Installer's Warranty:
      a. Warranty period: Two (2) Years.
      b. Installer will certify that a Paint Manufacturer's Representative tested the substrate according to Paint Manufacturer's standard procedures and have submitted project information and test patch forms.
      c. Installer shall certify that Paint Manufacturer's products were installed on the structure in accordance with manufacturer's specification requirements.
      d. Installer further agrees that if installer fails to fulfill their obligation under this certification statement within 30 days notice of the complaint, Paint Manufacturer may proceed with the investigation and repairs and shall pay the entire material cost, providing it wasn't the installer's responsibility.
   2. Water-Repellent Installer's Warranty:
      a. Warranty period: Two (2) Years.
      b. Installer will certify that a Water-Repellent Manufacturer's Representative tested the substrate according to Water-Repellent Manufacturer's standard procedures and have submitted project information and test patch forms.
      c. Installer shall certify that Water-Repellent Manufacturer's products were installed on the structure in accordance with manufacturer's specification requirements.
      d. Installer agrees:
         1) Investigate all complaints of leakage and/or water absorption on surfaces to which Water-Repellent Manufacturer's weatherproofing products were applied and provide a written report of the cause to Water-Repellent Manufacturer within thirty (30) days of the complaint.
         2) Re-apply Water-Repellent Manufacturer's weatherproofing products according to Water-Repellent Manufacturer's standard procedures at installer's cost for labor and material if the leakage and/or water absorption

is due to improper surface preparation, application and/or improper use of material.

3) Request authority from Water-Repellent Manufacturer to re-apply Water-Repellent Manufacturer's weatherproofing products at Water-Repellent Manufacturer's expense to areas, which were not rendered hydrophobic due to imperfect weatherproofing materials.

e. Installer further agrees that if installer fails to fulfill their obligation under this certification statement within 30 days notice of the complaint, Water-Repellant Manufacturer may proceed with the investigation and repairs and shall pay the entire cost, providing it wasn't the installer's responsibility.

1.9 MAINTENANCE

A. Extra Materials:

1. Quantity: 10 percent of quantity needed to paint Project, but not to exceed one gallon, of each type and color of finish coat used.

2. Identification: At project completion, provide an itemized list complete with manufacturer, paint type and color coding for all colors used, and locations within the Project for Owner's later use in maintenance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified paint coating product manufacturer, or approved equivalent:

a. PPG PAINTS.

1) Composed of the following companies: AMERITONE PAINT, DECRATREND, DEFT, DEVOE COATINGS, DEVOE PAINT, FLOOD WOOD CARE, FULLER O'BRIEN, GLIDDEN, and SINCLAIR PAINT.

b. Also specified: GEMINI and MONOPOLE.

c. Acceptable alternative manufacturers:

1) DUNN EDWARDS, KELLY MOORE PAINTS, SHERWIN WILLIAMS, BENJAMIN MOORE and VISTA PAINT. Submittals by these manufacturers, subject to specification requirements, must be in accordance with Section - SUBMITTAL PROCEDURES.

a) Paint material quality and systems shall be equal to numbers and systems listed in Paint Finish Schedule at the end of this section.

b) If submitted paint numbers differ from Darden Architects, Inc. Paint Equivalency List, additionally submit explanation of difference and certification letter from the installer attesting that the different product is equal to or better than specified; i.e. equivalent or better percentage of solids, system ODFT, and VOC compliant. Paint Equivalency List published by Darden Architects, Inc. is available only for this project at written request.

2. Specified water-borne Alkyltrialkoxy Silane water repellent product manufacturer, or approved equivalent:
   a. EVONIK DEGUSSA CORPORATION.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   1. Shop Primers or Coil-Coated Primers: It shall be assumed that all Shop Primed or Coil-Coated primed metals do not meet the requirements for primer material and mil thickness as defined herein. As such, all Shop Primed or Coil-Coated primed metals shall be field primed as indicated in the schedule.

B. Material Quality: Provide manufacturer's best-quality coating material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
   1. All materials used shall be lead and mercury free and shall have low VOC content to meet the applicable standards in the area where the Project is located.
   2. All paint materials shall have good flowing and brushing properties and shall dry or cure free of blemishes, sags, air entrapment, etc.
   3. All Water-Repellant Coatings shall comply with the following:
      a. Provide Alkyltrialkoxy Silane combination with a ratio concentration and application procedure as recommended by the manufacturer with the ability to cover in one or more applications for a ten year warranty in accordance with the following substrates:
         1) Concrete.
         2) Concrete Masonry Units
         3) Concrete Masonry Veneer
         4) Split-Faced Concrete Masonry Units.
      b. Color: Clear.
      c. Active Substance: Alkyltrialkoxy Silane.
      d. Active Content: 100 percent.
      e. Solvent: Water.
      f. Flash Point (Concentrate): 93 degrees F.
      g. Flash Point (Mixed): 200 degrees F.
      h. Density: 7.77 lbs./gallon.
      i. VOC (19:1): 50 g/liter (Maximum).
      j. VOC (9:1): 100 g/liter (Maximum).
      k. VOC (6:1): 200 g/liter (Maximum).
   4. All Bituminous Paint:
      a. Shall comply with Cold-Applied Asphalt-Mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil thickness per coat.

2.3 MIXES

A. Mixing and Tinting:
   1. Unless otherwise specified herein or pre-approved, all paint shall be ready-mixed and pre-tinted at the factory. Re-mix all paint in containers prior to and during application to

ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity.

2. Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
3. Where thinner is used, addition shall not exceed paint manufacturer's written recommendations.
4. Do not use kerosene or any such organic solvents to thin water-based paints.
5. Thin paint for spraying in strict accordance with paint manufacturer's written instructions. If directions are not on the container, obtain instructions in writing from the manufacturer and provide one copy of instructions to the Project Inspector.

2.4 FINISHES

A. Finish Colors:

1. Unless otherwise specified herein, all painting work shall be in accordance with MPI Premium Grade finish requirements as a minimum.

2. Determined by Architect prior to or as work progresses.

   a. Colors to be selected from paint manufacturer's full color systems, including standard, premium and custom colors.

3. When deep or 'Ultra colors' are selected, submit to Architect proposed revision to specified system product numbers, according to manufacturer's written recommendations.

   a. When deep or ultra colors are selected for use on walls or special color treatments such as graphics or many color changes are desired, the areas and extent of use will be clarified upon request of the Contractor.

4. Gloss standards, in accordance with MPI standards, using the ASTM D 523 "Test for Specular Gloss", are as follows:

Gloss Level	**Description**	**Units at 60 degrees**	**Units at 85 degrees**
G1	Matte or Flat Finish	0 to 5	10 max.
G2	Velvet Finish	0 to 10	10 to 35
G3	Eggshell Finish	10 to 25	10 to 35
G4	Low Sheen or Satin Finish	20 to 35	35 min.
G5	Semi-Gloss Finish	35 to 70	
G6	Gloss Finish	70 to 85	
G7	High-Gloss Finish	Greater than 85	

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual that affects the execution of work under this specification section.

   a. Thoroughly examine (and test as required, if necessary) all conditions and surfaces to be painted and report in writing to the Contractor and the Architect any conditions or surfaces that will adversely affect the work of this section.

   b. The Installer is responsible for verifying the compatibility of items primed by others and the finish coat or coats required by the Contract Documents. Should an

incompatibility occur, the Installer (along with the manufacturer's technical representative) will recommend compatible alternatives for the Architect's approval.

2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.

3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Protection before Application:

1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

2. Removal of Hardware and Miscellaneous Items:

   a. Coordinate the work with other trades so that they remove electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings, fastenings, and the like prior to starting work under this Section.
   b. Store during painting work. Coordinate cleaning and reinstallation after painting work is finished.
   c. Do not use solvent or cleaning agents detrimental to permanent finishes.
   d. Remove doors before painting to paint bottom and top edges, and then re-hang.

3. Protect adjacent surfaces against damage from painting operations. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

   a. Protective means include: Drop cloths, shields, masking templates, etc.
   b. Exterior surfaces include: landscaping, walks, drives, adjacent building surfaces, glazing, aluminum surfaces, etc.
   c. Interior surfaces include: rating and instruction labels on doors, frames, equipment, piping, etc.

B. Surface preparation:

1. General:

   a. In accordance with MPI Standards.

   b. Surfaces to be finished shall be clean, dry and free of dirt, passivators, oils, loose paint and any other contamination that would adversely affect adhesion, protective properties or appearance of the coating.
   c. All oil, grease, dirt or other foreign matter shall be removed by washing with a solution of cleaner and water, rinse and allow to dry.
   d. If efflorescence, alkali or glazed surfaces exist, neutralize with acid wash followed by thorough water rinsing.
      1) Protect all adjacent substrates or materials that could be affected by acid washing or water rinsing. Collect all washing & rinsing residue and dispose of away from structures.

2. Wood Substrates - (New and Repaint Surfaces):

   a. Interior Surfaces: MPI Interior Surface Preparation, Chapter 3, Section 3.

   b. Exterior Surfaces: MPI Exterior Surface Preparation, Chapter 2, Section 3.

   c. Fill holes and other imperfections with putty or plastic wood to match natural finish before and after application of prime or seal coat.
   d. Provide necessary extra treatment over knots, pitch pockets, sappy portions and other defects to produce a proper base for painting.
   e. Sand down raised grain or rough surfaces.

f. Clean surfaces free of dust, soil and other foreign material.

3. Gypsum Board Substrates - (New and Repaint Surfaces):
   a. Interior Surfaces: MPI Interior Surface Preparation, Chapter 3, Section 3.
   b. Clean surfaces of dirt, laitance, excess mortar and foreign matter.
   c. Do all necessary minor sanding.
   d. Fill minor cracks, scratches, holes and nail heads.
4. Plaster Substrates - (New and Repaint Surfaces):
   a. Interior Surfaces: MPI Interior Surface Preparation, Chapter 3, Section 3.
   b. Exterior Surfaces: MPI Exterior Surface Preparation, Chapter 2, Section 3.
   c. Clean surfaces of dirt, laitance, excess mortar and foreign matter.
   d. Neatly patch, flush and smooth, minor cracks, holes, pits and other imperfections in plaster or concrete surfaces.
5. Concrete Substrates - (New and Repaint Surfaces):
   a. Interior Surfaces: MPI Interior Surface Preparation, Chapter 3, Section 3.
   b. Exterior Surfaces: MPI Exterior Surface Preparation, Chapter 2, Section 3.
   c. Clean surfaces of dirt, laitance, excess mortar and foreign matter.
   d. Neatly patch, flush and smooth, minor cracks, holes, pits and other imperfections in plaster or concrete surfaces.
6. Metal Substrates - (New and Repaint Surfaces):
   a. Interior Surfaces: MPI Interior Surface Preparation, Chapter 3, Section 3.
   b. Exterior Surfaces: MPI Exterior Surface Preparation, Chapter 2, Section 3.
   c. Shop Primed or Factory Primed Surfaces:
      1) Shop Primed or Factory Primed Surfaces are considered "un-primed" due to their mil thicknesses provided, and common incompatibility issues with specified coating system; and are suitable only for protection during transit (shipment and storage) until incorporated into the Project.
      2) Remove dust, oil and rust.
      3) Sand surface lightly.
      4) Touch up imperfections, scratches, surface damage, etc. with the appropriate primer.
      5) Field connection welds, soldered joints, burned and abraded portions shall be spot primed with the appropriate primer.
   d. Coil-Coated Product Surfaces:
      1) Coil-Coated Product Surfaces are considered "un-primed" due to their mil thicknesses provided, and the common incompatibility issues with specified coating system; and are suitable only for protection during shipment and storage until incorporated into the Project.
      2) Remove dust, oil and rust.
      3) Touch up imperfections, scratches, surface damage, etc. with the appropriate primer.
      4) Field connection welds, burned and abraded portions shall be spot primed with the appropriate primer.
      5) Field apply manufacturer's written recommended primer coat over entire surface compatible with substrate finish and finish coats indicated on the paint schedule.
   e. Un-primed Surfaces:
      1) Remove dust, rust, mill scale, grease and foreign matter by sand blasting or wire brushing.
      2) Surfaces to be smooth and ready to receive coatings.
   f. Non-Ferrous Metal, Galvanized, Aluminum, and Copper Surfaces:

1) Metal Etch and Solvent Clean per SSPC-SP 1 or clean with TSP or other appropriate cleaner followed by thorough water rinsing.

2) Brush Blast to standards of SSPC-SP 16, or if blasting is not feasible, sand thoroughly, wipe clean and apply a test patch for the coating specified.

3) Allow system to cure at least one week, then test adhesion per ASTM D 3359 "Standard Test Methods for Measuring Adhesion by Tape Test."

7. Concrete Block Surfaces - (New and Repaint Surfaces):
   a. Interior Surfaces: MPI Interior Surface Preparation, Chapter 3, Section 3.
   b. Exterior Surfaces: MPI Exterior Surface Preparation, Chapter 2, Section 3.
   c. Clean and free of all dirt, dust, rust, oil and free from all foreign matter.
   d. Test for moisture content.
      1) Do not coat if moisture is present.
      2) Concrete Blocks to be thoroughly dry and cured prior to coating.
   e. Do not coat Masonry wall if joints are not properly pointed, has excessive mortar drippings cracked units or shows signs of excessive efflorescence.
      1) Notify Architect promptly through General Contractor.
      2) Do not coat until unsatisfactory and unacceptable Concrete Block surfaces are corrected suitable for coating.
   f. Do not apply opaque finishes to Concrete Block with airless sprayer unless "backrolled."

3.3 APPLICATION

A. Standards:
   1. In accordance with MPI Painting Manual.
   2. In accordance with manufacturer's specifications.

B. Method:
   1. Apply by brush, roller or spray in accordance with MPI Painting Manual and the coating manufacturer's written recommendations except where specified otherwise in Schedule of Paint Finishes.
   2. Painting of doors by rollers shall only be allowed only if the applicator uses a 1/4 inch nap or less roller.

C. Coatings:
   1. All coatings shall be applied without reduction except as specifically required by label directions, or required to be reduced by this Specification. In such cases, reduction shall be the minimum permitted and shall not exceed VOC limits.
   2. Apply each coat evenly and allow each coat to dry prior to applying succeeding coats. Each coat to have enough consistency to conceal work to which it is applied.
      a. Follow manufacturer's recommendations for recoat windows when using high performance coatings, epoxys, and urethanes.
   3. Cut into a true line and leave smooth and clean without overlapping. Coat doors and windows in open position.
   4. Sand finishes on smooth surfaces to assure proper adhesion of subsequent coats.
   5. Tint each undercoat a lighter shade to facilitate identification of each coat, if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
   6. Apply coating systems so as to obtain not less than the dry film mil thickness recommended by the manufacturer.
   7. Sand metal work only as necessary to provide for the complete bonding of coats.

8. Project Inspector to inspect and approve each coat and operation before succeeding coats are applied.
9. Finish work to be free from runs, sags, defective application and improper workmanship.
10. Back prime all woodwork and casework coming in contact with plaster, masonry or concrete immediately upon delivery to project.
11. Post sign promptly following application of coatings.

3.4 FIELD QUALITY CONTROL

A. All surfaces, preparation and paint applications shall be inspected by the Project Inspector.

B. Painted exterior and interior surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the Painting Inspection by the Project Inspector:

1. Brush / Roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
2. Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
3. Damage due to touching before paint is sufficiently dry or any other contributory cause.
4. Damage due to application on moist surfaces or caused by inadequate protection from the weather.
5. Damage and / or contamination of paint due to blown contaminants (dust, spray paint, etc.).

C. Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:

1. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
2. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
3. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
4. When the final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.

D. Painted surfaces rejected by the Project Inspector shall be made good at the expense of the Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

3.5 CLEANING

A. Clean in accordance with Specification Section - TEMPORARY FACILITIES AND CONTROLS and PROJECT CLOSEOUT.

B. Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

C. Keep work area free from unnecessary accumulation of tools, equipment, surplus materials and debris.

D. Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.

E. Clean equipment and dispose of wash water / solvents as well as all other cleaning and protective materials (e.g., rags, drop cloths, masking papers, etc.), paints, thinners, paint

removers / strippers in accordance with the safety requirements of authorities having jurisdiction in the place where the Project is located.

F. Protect and safeguard work of other trades.

3.6 PROTECTION

A. Protection from Weather:
   1. Protect newly installed work from moisture for a period of time as recommended by the manufacturer after application.

B. Protection from Traffic:
   1. Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

3.7 SCHEDULES

A. Refer to Exterior and Interior Finish Schedules on Drawings for applicable finishes used. This is a guide only and paint sub-contractor is responsible to check all drawings and be responsible for all paint work required to cover the complete painting and finishing of the interior and exterior including specialty items.

B. It is the intent of the specifications and drawings to cover the complete painting and finishing of the Project whether or not it is specifically called for in the Specifications, Schedule of Paint Finishes, or indicated on the Drawings. Surfaces not specified in Paint Finishes Schedule shall be in accordance with manufacturer's written recommendations.
   1. Inform the Architect of any changes caused by stricter Air Quality Standards as part of the submittal process.
   2. Provide products compliant with Local Air Quality Control District requirements at the time of installation.

C. Exception: When the Project involves remodel work, the scope of work is limited to the remodel area and adjacent existing substrates to minimize visible color incompatibility.

D. Provide coating system minimum ODFT specified.
   1. Do not apply thicker coats than specified to achieve ODFT. Apply additional coats if necessary for unifrom color.

E. "Ultra Color" Note: A fourth and/or fifth coat may be required to achieve uniform chromatic hue without ghosting from undercoat or substrate.
   1. The Contractor shall consider all Metal Paint Finishes noted "Ultra-color" as requiring as many as five (5) total coats.

3.8 INTERIOR PAINT FINISHES:

A. INTERIOR WOODWORK
   1. W-1 Flat Latex Minimum ODFT 4.2 MILS.
      a. 1st Coat SPEEDHIDE ZERO (SPH-0) Primer 6-4900XI
      b. 2nd Coat Flat 0 VOC (SPH-0) 6-4110XI
      c. 3rd Coat Flat 0 VOC (SPH-0) 6-4110XI
   2. W-2 Semi-Gloss Acrylic Non-Blocking Enamel Minimum ODFT 4.0 MILS.

a. 1st Coat SPEEDHIDE ZERO (SPH-0) Primer 6-4900XI
b. 2nd Coat Semi-Gloss 0 VOC (SPH-0) 6-4510XI
c. 3rd Coat Semi-Gloss 0 VOC (SPH-0) 6-4510XI

3. W-3 Gloss Waterborne Acrylic Non-Blocking Enamel Minimum ODFT 9.4 MILS.

a. 1st Coat SPEEDHIDE ZERO (SPH-0) Primer 6-4900XI
b. 2nd Coat Gloss Acrylic PITT-TECH PLUS 90-1310
c. 3rd Coat Gloss Acrylic PITT-TECH PLUS 90-1310

4. W-4 Semi-Transparent Resin Stain Minimum ODFT 1.9 MILS.

a. 1st Coat Resin Wiping Stain DEFT Int. Stain
b. 2nd Coat Clear Acrylic DEFT Clear Wood

5. W-5 Semi-Transparent Resin Stain Minimum ODFT 3.3 MILS.

a. 1st Coat Resin Wiping Stain DEFT Int. Stain
b. 2nd Coat Clear Acrylic DEFT Clear Wood
c. 3rd Coat Clear Acrylic DEFT Clear Wood

6. W-6 Stained and Water Clear Lacquer Minimum ODFT 3.8 MILS.

a. 1st Coat Resin Wiping Stain DEFT Int. Stain
b. 2nd Coat Lacq. Sanding Sealer DEFT WB Sanding Sealer
c. 3rd Coat Clear Acrylic DEFT WB 109/S
d. 4th Coat Clear Acrylic DEFT WB 109/S

7. W-7 Filled and Sealed Floor Finish Minimum ODFT 3.0 MILS.

a. 1st Coat Paste Filler As recommended by Flooring Manufacturer
b. 2nd Coat Satin Polyurethane DEFT 26
c. 3rd Coat Satin Polyurethane DEFT 26

8. W-8 Velvet Lacquered Finish Minimum ODFT 4.7 MILS.

a. 1st Coat Lacq. Sanding Sealer DEFT WB Sanding Sealer
b. 2nd Coat Clear Acrylic DEFT WB 109/S
c. 3rd Coat Clear Acrylic DEFT WB 109/S
d. 4th Coat Clear Acrylic DEFT WB 109/S

B. INTERIOR GYPSUM BOARD

1. DW-1 Flat Latex Minimum ODFT 4.2 MILS.

a. 1st Coat SPEEDHIDE ZERO (SPH-0) P/S 6-4900XI
b. 2nd Coat Flat 0 VOC (SPH-0) 6-4110XI
c. 3rd Coat Flat 0 VOC (SPH-0) 6-4110XI

2. DW-2 Eggshell Acrylic Non-Blocking Enamel Minimum ODFT 4.0 MILS.

a. 1st Coat SPEEDHIDE ZERO (SPH-0) Primer 6-4900XI
b. 2nd Coat Eggshell 0 VOC (SPH-0) 6-4310XI
c. 3rd Coat Eggshell 0 VOC (SPH-0) 6-4310XI

3. DW-3 Gloss Acrylic Non-Blocking Enamel Minimum ODFT 9.4 MILS.

a. 1st Coat SPEEDHIDE ZERO (SPH-0) Primer 6-4900XI
b. 2nd Coat Gloss Acrylic PITT-TECH PLUS 90-1310
c. 3rd Coat Gloss Acrylic PITT-TECH PLUS 90-1310

4. DW-4 Gloss Epoxy Polyamide (Corrosion Resistant) Minimum ODFT 7.6 MILS.

a. 1st Coat Acrylic Primer SEAL GRIP 17-921
b. 2nd Coat Epoxy Gloss AQUAPON WB-EP 98E-1
c. 3rd Coat Epoxy Gloss AQUAPON WB-EP 98E-1

5. DW-4 WB Semi-Gloss Epoxy (Corrosion Resistant) Minimum ODFT 4.6 MILS.

   a. 1st Coat Acrylic Primer SEAL GRIP 17-921
   b. 2nd Coat Epoxy Semi-Gloss PITT-GLAZE 16-510
   c. 3rd Coat Epoxy Semi-Gloss PITT-GLAZE 16-510

6. DW-5 Semi-Gloss Acrylic Non-Blocking Enamel Minimum ODFT 4.0 MILS.

   a. 1st Coat SPEEDHIDE ZERO (SPH-0) Primer 6-4900XI
   b. 2nd Coat Semi-Gloss 0 VOC (SPH-0) 6-4510XI
   c. 3rd Coat Semi-Gloss 0 VOC (SPH-0) 6-4510XI
   d. Note: This system was previous named "DW-2".

C. INTERIOR CEMENT PLASTER, VENEER PLASTER OR GYPSUM PLASTER

1. P-1 Flat Latex Minimum ODFT 5.4 MILS.

   a. 1st Coat Acrylic Primer-Sealer 4-603XI
   b. 2nd Coat Flat 0 VOC (SPH-0) 6-4110XI
   c. 3rd Coat Flat 0 VOC (SPH-0) 6-4110XI

2. P-2 Eggshell Acrylic Non-Blocking Enamel Minimum ODFT 5.6 MILS.

   a. 1st Coat Acrylic Primer-Sealer 4-603XI
   b. 2nd Coat Eggshell 0 VOC (SPH-0) 6-5310
   c. 3rd Coat Eggshell 0 VOC (SPH-0) 6-5310

3. P-3 Gloss Acrylic Non-Blocking Enamel Minimum ODFT 10.6 MILS.

   a. 1st Coat Acrylic Primer-Sealer 4-603XI
   b. 2nd Coat Gloss Acrylic PITT-TECH PLUS 90-1310
   c. 3rd Coat Gloss Acrylic PITT-TECH PLUS 90-1310

4. P-4 Gloss Epoxy Polyamide (Corrosion Resistant) Minimum ODFT 7.6 MILS.

   a. 1st Coat Acrylic Primer SEAL GRIP 17-921
   b. 2nd Coat Epoxy Gloss AQUAPON WB EP 98E-1 Series
   c. 3rd Coat Epoxy Gloss AQUAPON WB EP 98E-1 Series

5. P-4 WB S/G Epoxy (Corrosion Resistant) Minimum ODFT 4.6 MILS.

   a. 1st Coat Acrylic Primer SEAL GRIP 17-921
   b. 2nd Coat WB Epoxy Semi-Gloss PITT-GLAZE 16-510
   c. 3rd Coat WB Epoxy Semi-Gloss PITT-GLAZE 16-510

6. P-5 Semi-Gloss Acrylic Non-Blocking Enamel Minimum ODFT 5.2 MILS.

   a. 1st Coat Acrylic Primer-Sealer 4-603XI
   b. 2nd Coat Semi-Gloss 0 VOC (SPH-0) 6-4510XI / 6-5510
   c. 3rd Coat Semi-Gloss 0 VOC (SPH-0) 6-4510XI / 6-5510

D. INTERIOR CONCRETE OR CONCRETE MASONRY UNITS

1. CB-1 Clear Water Repellent Sealer

   a. One Coat Alkyltrialkoxy Silane

      1) EVONIK DEGUSSA "Aqua-Trete®CONCENTRATE."

   b. Follow manufacturer's recommended coverage rate and installation recommendations for type of substrate to be covered.
   c. Provide manufacturer's 10 year warranty for Concrete Masonry Units and Split Faced Concrete Masonry Units.

2. CB-2 Flat Latex - Fine Texture Minimum ODFT 9.9 MILS.

   a. 1st Coat Acrylic Block Filler (SPH-0) 6 - 7

1) Omit at concrete surfaces.

b. 2nd Coat Flat 0 VOC (SPH-0) 6-4110XI
c. 3rd Coat Flat 0 VOC (SPH-0) 6-4110XI

3. CB-3 Semi-Gloss Acrylic Enamel:

a. Concrete Masonry Units: Minimum ODFT 9.7 MILS.

1) 1st Coat Acrylic Block Filler (SPEEDHIDE INT/EXT BLOCK FILL)
2) 2nd Coat Flat 0 VOC (SPH-0) 6-4510XI
3) 3rd Coat Flat 0 VOC (SPH-0) 6-4510XI

b. Concrete Surfaces: Minimum ODFT 4.6 MILS.

1) 1st Coat Acrylic Primer-Sealer 3210
2) 2nd Coat Flat 0 VOC (SPH-0) 6-4510XI
3) 3rd Coat Flat 0 VOC (SPH-0) 6-4510XI

4. CB-4 Color High-Gloss Polyamide Epoxy:

a. Concrete Masonry Units: Minimum ODFT 15.6 MILS.

1) 1st Coat W/B Epoxy Block Fill SPEEDHIDE HI-FILL INT/EXT BLOCK FILL
2) 2nd Coat Acrylic Primer SEAL-GRIP 17-921
3) 3rd Coat Epoxy Gloss AQUAPON WB EP 98E-1
4) 4th Coat Epoxy Gloss AQUAPON WB EP 98E-1

b. Concrete Surfaces: Minimum ODFT 7.6 MILS.

1) 1st Coat Epoxy Primer SEAL-GRIP 17-921
2) 2nd Coat Epoxy Gloss AQUAPON WB EP 98E-1
3) 3rd Coat Epoxy Gloss AQUAPON WB EP 98E-1

5. CB-4 Color WB Semi-Gloss Epoxy:

a. Concrete Masonry Units: Minimum ODFT 15.6 MILS.

1) 1st Coat W/B Epoxy Block Fill SPEEDHIDE 6-15
2) 2nd Coat Epoxy Primer SEAL-GRIP 17-921
3) 3rd Coat Epoxy S/G PITT-GLAZE 16-510
4) 4th Coat Epoxy S/G PITT-GLAZE 16-510 DFT 3.0 mils.

b. Concrete Surfaces: Minimum ODFT 7.6 MILS.

1) 1st Coat Epoxy Primer SEAL-GRIP 17-921
2) 2nd Coat Epoxy S/G PITT-GLAZE 16-510
3) 3rd Coat Epoxy S/G PITT-GLAZE 16-510

6. CB-5 Clear High-Gloss Polyamide Epoxy Minimum ODFT 5.0 MILS.

a. 1st Coat Epoxy Gloss MONOPOLE Permashield 200
b. 2nd Coat Epoxy Gloss MONOPOLE Permashield 200

E. INTERIOR METALS

1. PRIMER NOTE: Metals that are shop primed shall be considered "un-primed" and shall be primed with appropriate primer and thicknesses listed below:

a. Ferrous Metal:

1) PPG PITT-TECH PLUS 4020 "Red" Mult-Purp. Metal Primer DFT 3.0 mils.

b. Non-Ferrous Metal, Galvanized Metal or Aluminum:

1) PPG PITT-TECH PLUS 4020 "White" Mult-Purp. Metal Primer DFT 3.0 mils.

2. COIL-COATED PRODUCTS NOTE: Metal products primed with coil-coated products are to be assumed to be "un-primed" products and shall be additionally coated (or primed again) as follows:

a. Coil-Coated Products:

1) Field apply manufacturer's recommended primer coat and mil thickness over entire surface compatible with substrate finish and finish coats indicated on paint schedule.

3. M-1 Flat Latex Minimum ODFT 5.8 MILS.

a. 1st Coat Primer See primer note above.
b. 2nd Coat Flat 0 VOC (SPH-0) 6-4110XI
c. 3rd Coat Flat 0 VOC (SPH-0) 6-4110XI

4. M-2 Semi-Gloss "Ultra Color" Industrial AcrylicMinimum ODFT 11.0 MILS.

a. 1st Coat Primer See primer note above.
b. 2nd Coat Acrylic Semi-Gloss PITT-TECH PLUS 90-1610
c. 3rd Coat Acrylic Semi-Gloss PITT-TECH PLUS 90-1610

5. M-3 Gloss "Ultra Color" Waterborne Acrylic Minimum ODFT 11.0 MILS.

a. 1st Coat Primer See primer note above.
b. 2nd Coat Gloss Acrylic PITT-TECH PLUS 90-1310
c. 3rd Coat Gloss Acrylic PITT-TECH PLUS 90-1310

6. M-4 Semi-Gloss Epoxy Polyamide Minimum ODFT 6.0 MILS.

a. 1st Coat Primer See primer note above.
b. 2nd Coat Epoxy Semi-Gloss PITT-GLAZE 16-510
c. 3rd Coat Epoxy Semi-Gloss PITT-GLAZE 16-510

7. M-5 Gloss Epoxy Polyamide Minimum ODFT 4.6 MILS.

a. 1st Coat Epoxy Primer SEAL-GRIP 17-921
b. 2nd Coat Epoxy Gloss AQUAPON WB EP 98E-1 Series
c. 3rd Coat Epoxy Gloss AQUAPON WB EP 98E-1 Series

8. M-5 Water Base S/G Epoxy (Corrosion Resistant) Minimum ODFT 7.6 MILS.

a. 1st Coat Acrylic Primer SEAL GRIP 17-921
b. 2nd Coat WB Epoxy S/G PITT-GLAZE 16-510
c. 3rd Coat WB Epoxy S/G PITT-GLAZE 16-510

9. M-6 Flat Waterborne Paint Minimum ODFT 4.4 MILS.

a. 1st Coat Flat Dry Fall Prime SUPER TECH 6-726XI
b. 2nd Coat Flat Dry Fall Finish SUPER TECH 6-726XI

10. M-7 Semi-Gloss Waterborne Paint Minimum ODFT 4.4 MILS.

a. 1st Coat S/G Dry Fall Primer SUPER TECH 6-724XI
b. 2nd Coat S/G Dry Fall Finish SUPER TECH 6-724XI

11. M-8 Satin Industrial Acrylic Minimum ODFT 11.0 MILS.

a. 1st Coat Primer See primer note above.
b. 2nd Coat Acrylic Satin PITT-TECH PLUS 90-1110
c. 3rd Coat Acrylic Satin PITT-TECH PLUS 90-1110

F. INTERIOR ACOUSTICAL TILE

1. A-1 Matte Flat Vinyl Acrylic Minimum ODFT 1.3 MILS.

    a. 1st Coat Flat Vinyl Acrylic PRO-EV 0-VOC 12-110

3.9 EXTERIOR PAINT FINISHES

A. EXTERIOR WOOD

1. EW-1 Flat 100 percent Acrylic Minimum ODFT 6.0 MILS.

    a. 1st Coat Epoxy Primer SEAL-GRIP 17-921
    b. 2nd Coat 100 percent Acrylic Flat SUNPROOF 72-Series
    c. 3rd Coat 100 percent Acrylic Flat SUNPROOF 72-Series

2. EW-2 Semi-Gloss 100 percent Acrylic Minimum ODFT 5.6 MILS.

    a. 1st Coat Epoxy Primer SEAL-GRIP 17-921
    b. 2nd Coat 100 percent Acrylic Semi-Gloss SUNPROOF 78-Series
    c. 3rd Coat 100 percent Acrylic Semi-Gloss SUNPROOF 78-Series

3. EW-3 100 percent Acrylic Resin (A/R) Stain Minimum ODFT 3.0 MILS.

    a. 1st Coat 100 percent A/R Stain Coat FLOOD SWF
    b. 2nd Coat 100 percent A/R Stain Coat FLOOD SWF

B. EXTERIOR CEMENT PLASTER

1. EP-1 Flat 100 percent Acrylic Minimum ODFT 7.0 MILS.

    a. 1st Coat 100 percent Acrylic Primer-Sealer 4-603XI
    b. 2nd Coat 100 percent Acrylic Flat SUNPROOF 72-Series
    c. 3rd Coat 100 percent Acrylic Flat SUNPROOF 72-Series

2. EP-2 Semi-Gloss 100 percent Acrylic Minimum ODFT 6.6 MILS.

    a. 1st Coat 100 percent Acrylic Primer-Sealer 4-603XI
    b. 2nd Coat 100 percent Acrylic Semi-Gloss SUNPROOF 78-Series
    c. 3rd Coat 100 percent Acrylic Semi-Gloss SUNPROOF 78-Series

C. EXTERIOR CONCRETE OR CONCRETE MASONRY UNITS:

1. ECB-1 Clear Water Repellent Sealer:

    a. One Coat Alkyltrialkoxy Silane:

        1) EVONIK DEGUSSA "Aqua-Trete®CONCENTRATE."

    b. Provide manufacturer's 10 year warranty for Concrete Masonry Units and Split Faced Concrete Masonry Units.

D. EXTERIOR METAL

1. PRIMER NOTE: Metals shop primed shall be considered "un-primed" • and shall be primed with appropriate primer and thicknesses listed below:

    a. Ferrous Metal, Type 1 Typical:

        1) PITT TECH PLUS 4020 "Red" Multi-Purpose Metal Primer DFT 3.0 mils.

    b. Ferrous Metal, Type 2 as specified in Specification Section – STEEL AND FABRICATIONS:

        1) AMERCOAT 68HS Reinforced Inorganic Zinc-Rich Urethane Metal Primer DFT 5.0 mils.

    c. Ferrous Metal, Type 3 when Urethane is used as a finish:

1) AMERLOCK 2VOC/400 VOC Epoxy Metal Primer DFT 6.0 mils.

d. Non-Ferrous Metal, Type 4 Galvanized Metal or Aluminum:

1) PITT TECH PLUS "White" Multi- Purpose Metal Primer DFT 3.0 mils.

e. Non-Ferrous Metal, Type 5 Galvanized Metal or Aluminum, when Urethane is used as a finish.

1) AMERLOCK 2VOC/400 VOC Epoxy Metal Primer DFT 6.0 mils.

2. COIL-COATED PRODUCTS NOTE: Metal products primed with coil-coated products are to be assumed to be unprimed products and shall be re-primed as follows:

a. Coil-Coated Products:

1) Field apply manufacturer's recommended primer coat and mil thickness over entire surface compatible with substrate finish and finish coats indicated on paint schedule.

3. EM-1 Flat 100 percent Acrylic Minimum ODFT 7.4 MILS.

a. 1st Coat Primer See primer notes above.
b. 2nd Coat 100 percent Acrylic Flat SUNPROOF 72-Series
c. 3rd Coat 100 percent Acrylic Flat SUNPROOF 72-Series

4. EM-2 Semi-Gloss "Ultra Color" 100 percent Acrylic Minimum ODFT 7.2 MILS.

a. 1st Coat Primer See primer notes above.
b. 2nd Coat 100 percent Acrylic Semi-Gloss SUNPROOF 78-Series
c. 3rd Coat 100 percent Acrylic Semi-Gloss SUNPROOF 78-Series

5. EM-3 Gloss "Ultra Color" 100 percent Acrylic Waterborne Minimum ODFT 11.0 MILS.

a. 1st Coat Primer See primer notes above.
b. 2nd Coat Gloss Acrylic PITT-TECH PLUS 90-1310
c. 3rd Coat Gloss Acrylic PITT-TECH PLUS 90-1310

6. EM-4 Gloss "Ultra Color" Aliphatic Acrylic Urethane (A/A/U) Finish, Spray Applied, Deep Tone, Custom Color Minimum ODFT 16.0 MILS.

a. 1st Coat Primer See primer notes above.
b. 2nd Coat A/A/U Gloss Color AMERSHIELD VOC
c. 3rd Coat A/A/U Gloss Color AMERSHIELD VOC

7. EM-5 Gloss "Ultra Color" Aliphatic High Solids Finish, Spray Applied, Deep Tone, Custom Color with clear protective coats Minimum ODFT 18.0 MILS.

a. 1st Coat Primer See primer notes above
b. 2nd Coat A/A/U Gloss Color AMERSHIELD VOC
c. 3rd Coat A/A/U Gloss Color AMERSHIELD VOC
d. 4th Coat A/A/U Gloss Clear AMERSHIELD VOC
e. 5th Coat A/A/U Gloss Clear AMERSHIELD VOC

8. EM-6 Semi-Gloss "Ultra Color" Aliphatic Urethane (A/U) Finish, Spray Applied, Deep Tone, Custom Color Finish Minimum ODFT 20.0 MILS.

a. 1st Coat Primer See primer notes above.
b. 2nd Coat A/A/U Semi-Gloss AMERCOAT 240
c. 3rd Coat A/A/U Semi-Gloss AMERSHIELD VOC

3.10 SPECIALTY PAINT FINISHES:

A. PROVIDE SPECIALTY PAINT FINISHES AS SHOWN OR AS FOLLOWS:

1. **Finish No. X-1:** Minimum ODFT 15.0 MILS.
   a. Lines on Concrete or Asphaltic Concrete Paving Exit and Entrance Signs - 10" width lines, maximum. Reflectorize as required.
   b. PPG ZoneLine
2. **Finish No. X-2:** Minimum ODFT 15.0 MILS.
   a. Lines on Walk Top. Colors as selected by Architect.
      1) PPG ZoneLine
3. **Finish No. X-3:** Minimum ODFT 2.2 MILS.
   a. Space above Vents or Grilles.
   b. 1st Coat 100 percent Acrylic Flat Black 72-Series
4. **Finish No. X-4:** Minimum ODFT 7.0 MILS.
   a. Piping Black Steel or Cast Iron.
   b. 1st Coat Multi-Purpose Metal Primer: PITT TECH PLUS 4020 "Red"
   c. 2nd Coat Acrylic Gloss Finish 2406G
5. **Finish No. X-5:** Minimum ODFT 7.0 MILS.
   a. Piping Galvanized.
   b. 1st Coat General Purpose Metal Primer. PITT TECH PLUS 4020 "White"
   c. 2nd Coat Gloss Enamel Finish: PITT TECH PLUS 90-1310
6. **Finish No. X-6:** Minimum ODFT 11.0 MILS.
   a. Machinery and Equipment (Coil Coated Products):
   b. 1st Coat General Purpose Metal Primer: PITT TECH PLUS 4020 "White”
   c. 2nd Coat Gloss Enamel PITT TECH PLUS 90-1310
   d. 3rd Coat Gloss Enamel PITT TECH PLUS 90-1310
7. **Finish No. X-7:** Minimum ODFT 7.0 MILS.
   a. Sheet Metal Ducts:
   b. 1st Coat General Purpose Metal Primer: PITT TECH PLUS 4020 "White”
   c. 2nd Coat 100 percent Acrylic Flat: PITT TECH PLUS 90-1310
8. **Finish No. X-8:** Minimum ODFT 7.0 MILS.
   a. Fire Hydrants:
   b. 1st Coat General Purpose Metal Primer: PITT TECH PLUS 4020 "White”
   c. 2nd Coat 100 percent Acrylic Flat: PITT TECH PLUS 90-1310
9. **Finish No. X-9:** Minimum ODFT 7.4 MILS.
   a. Following items listed will receive Finish No. X-9 (including, but not limited to), Louvers, Grilles, or Access Panels.
   b. 1st Coat General Purpose Metal Primer: PITT TECH PLUS 4020 "White”
   c. 2nd Coat 100 percent Acrylic Flat SUNPROOF FLAT 72-Series
   d. 3rd Coat 100 percent Acrylic Flat SUNPROOF FLAT 72-Series
10. **Finish No. X-10:** Minimum ODFT 1.9 MILS.
    a. Striping under Acoustical Board Surrounding Structure:
    b. 1st Coat 100 percent Acrylic Flat Black SUNPROOF FLAT 72-Series
11. **Finish No. X-11:** Minimum ODFT 2.2 MILS.
    a. Acoustical Board and Exposed Striping and Structural:
    b. 1st Coat 100 percent Acrylic Flat Black SUNPROOF FLAT 72-Series

END OF SECTION

SECTION 100500 – MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Provision for and installation of specialty and built-in items required for this Work as indicated on the Drawings.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 30 00 CAST-IN-PLACE CONCRETE
4. 04 22 00 CONCRETE MASONRY UNITS
5. 05 12 00 STEEL AND FABRICATIONS
6. 05 30 00 METAL DECK
7. 06 10 00 ROUGH CARPENTRY
8. 06 22 00 MILLWORK
9. 06 41 23 MODULAR CASEWORK
10. 07 60 00 SHEET METAL
11. 08 11 10 METAL DOORS AND FRAMES
12. 08 70 00 HARDWARE
13. 08 80 00 GLASS
14. 09 11 00 METAL FRAMING
15. 09 24 00 CEMENT PLASTER
16. 09 29 00 GYPSUM BOARD
17. 09 50 00 ACOUSTICAL CEILINGS
18. 09 65 10 RESILIENT BASE AND ACCESSORIES
19. 09 72 00 WALL COVERINGS
20. 09 91 00 PAINTING
21. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
22. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements: It is the intention of this section and the drawings to form a guide for a complete and operable system of all products or systems listed within this specification section. Any items not specifically noted but necessary for a complete and operable product or system shall be provided under this section.

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
1. Shop Drawings:
a. Submit Shop Drawings and catalog cuts to the architect showing all details of installation and assembly and all requirements for work by other trades.
2. Product Data:
a. Submit manufacturer's full color range (including any standard, premium and custom colors) for selection by the Architect.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Storage and protection:
1. Use all means necessary to protect all specialty items before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements:
1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

1.5 PROJECT CONDITIONS

A. Existing Conditions:
1. Surface Conditions:
a. Coordination: Coordinate with all other trades as required to ensure proper and adequate provision in framing and wall finish for the installation of the selected specialties in the locations required.
2. Inspection:
a. Prior to Installation, inspect all specific locations and verify that all necessary provisions have been made.
b. In the event of discrepancy, immediately notify the Architect.
c. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

1.6 WARRANTY

A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer’s Warranty:
1. In accordance with manufacturer's written standard warranty:
a. Warranty Period One (1) Year.

C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES:
a. Warranty period One (1) Year.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all specialty items where indicated on the Drawings and in full accordance with all pertinent regulations and the manufacturer's written recommendations, anchoring all components firmly in place for long life under hard use, and in accordance with IR (Interpretation of Regulations, “Division of the State Architect•)Manual.

3.2 ADJUSTING

A. Upon completion of the installation, and as a condition of its acceptance, visually inspect the entire work of this Section, adjust all components for proper alignment and use, and touch up all abrasions and scratches to make them completely invisible.

3.3 SCHEDULES

A. All items shall be as scheduled or approved equivalent items as set forth in the Substitution Section of these specifications, and all provisions of Division 00 - GENERAL CONDITIONS, and the sections of Division 01.

B. Bicycle Rack:
1. Specified Bicycle Rack products manufacturer, or approved equivalent:
   a. LA STEELCRAFT "BAX Series"
      1) Bike Rack, 8 bicycle capacity "BAX-8".
2. Bike Racks that features a "Separate Wheel Holder" that can be spaced 16 inches apart facing one direction for a total capacity of eight bikes.
   a. Wheel Holders are individually welded units made of 1/2 inch steel rods.
   b. Holder Base is bolted to 1-1/2 inch x 1-1/2 inch x 3/16 inch steel angle, with holes for anchoring to substrate, running through the length of the Bike Rack.
3. The entire Bike Rack shall be hot-dipped galvanized finish after fabrication.

C. Bicycle Vault
1. Provide and install Bicycle Vault, "Single Bike Vault" as manufactured by HUNTCO.
   a. Dimensions
      1) Length: 76 inches.
      2) Width: 30 inches.
      3) Height: 47.25 inches.
   b. Construction Material
      1) 12-gauge steel sheet unperforated door.
      2) 14 and 16-gauge steel sheet vault body.
   c. Mounting
      1) Surface mounted with self-leveling feet
   d. Finish
      1) Factory applied powder coat finish.
      2) Color as selected by the Architect from the manufacturers full color line, including any custom colors.

D. Overhead Fan:
1. Provide and install Overhead Fan as manufactured by BIG ASS FANS.
   a. Model: ESSENCE
   b. Finish color: Silver Motor Housing with Black Trim.
   c. Fan blade diameter: 10' - 0".
   d. Rating: Outdoor.
   e. Fan unit weight: 81 Pounds
   f. Maximum speed: 107 RPM
   g. Sound at maximum speed: <35 dBA
   h. Power requirements: 110-125 VAC, 1 phase, 60 Hz, 10A.
      1) Controller: Wall control mounted to recessed wall junction box.
      2) Coordinate all work with the Electrical Drawings.
   i. Accessories:
      1) LED Light.

2) Wireless Controller

E. Dimensional Letters:
1. "Fabricated Metal":
   a. Provide and install, where shown on the drawings, Dimensional Letters as manufactured by GEMINI INC., or approved equivalent.
      1) Dimensional Letters shall be fabricated with 18-gage "Cut and Fabricated" letters and 1/8 inch backer plate.
      2) Mounting: Stud at back of letter as indicated in the drawings.
      3) Letter style: As indicated in the Drawings.
      4) Finish: Painted or primed to receive paint in field. Condition varies. Refer to Exterior Finish Schedule and Exterior Color Schedule for more information.
   b. Material: Type 304 Prefinished Stainless Steel.
2. Laser Cut Acrylic
   a. Provide and install, where shown on the drawings, Dimensional Letters as manufactured by FAST SIGNS, or approved equivalent.
      1) Dimensional Letters shall be made of 3/8” thick Acrylic
      2) Mounting: Stud at back of as indicated in the drawings.
      3) Letter and Size: As indicated in the drawings.
      4) Logo and Size: As indicated in the drawings, architect to provide graphic file of logo.
      5) Finish: As indicated in the Interior Color Schedule.
      6) Each Letter, Symbol or Shape to weigh less than 20 lbs.
3. Flat Cut
   a. Provide and install, where shown on the drawings, Dimensional Letters as manufactured by GEMINI INC., or approved equivalent.
      1) Dimensional Letters shall be ¼” flat cut bronze
      2) Mounting: Stud and stabilizer mounted to be recessed into concrete slab
         a) Stabilizer bar to be 1/8” thick 6063-T2 extruded aluminum (if contact with rebar is unavoidable, stabilizer bar to be stainless steel)
         b) Threaded studs with double nuts to be installed per manufacturer’s recommendation.
         c) Contractor to coordinate installation of dimensional letters with concrete slab and rebar prior to installation.
         d) Logo Size: As indicated in the drawings. Architect to provide graphic file of logo.
         e) Finish: As indicated in the Interior Color Schedule.

F. Fire Alarm Annunciator:
1. Provide and install as shown on the Drawings, annunciator Panel, Cabinet and Support Frame.
2. Annunciator Panel shall be fabricated of 1/4" thick Fiberglass or plastic manufactured for exterior use and protected in Cabinet with 1/4" clear Lexan cover. Annunciator Panel and copy/graphics shall be in three colors and incorporate a Low Voltage Light System, including wiring, transformer and panel mounted lamps of appropriate scale. Low Voltage Light System power connection shall be made under Electrical Specification Section EQUIPMENT CONNECTIONS. Copy/graphics will be provided in rough form by the Architect. Colors shall be selected by the Architect from the Annunciator Panel manufacturer's full range.

3. Cabinet shall be 48" x 60" x 18" deep (nominal dimension), fabricated of 14 gage Stainless Steel with Mirror Polish finish. Support Frame shall be fabricated of steel with Galvanized finish. Cabinet and Support Frame shall be all welded construction with all welds ground smooth and flush. Polishing and galvanizing shall be accomplished after fabrication.
4. Coordinate related work, materials and mounting locations. Submit full size drawings incorporating copy/graphics provided by the Architect for approval. Submit Shop Drawings, Product Data for Low Voltage Light System, and Sample of panel material showing three color process.

G. Lock Box: Provide Rapid Entry System Recessed Lock Box as manufactured by KNOX CO. Model #3200-R, Heavy-Duty, Medium Capacity, holds 10 keys maximum, 4" W x 5" H x 3-1/4" D.
   a. Door shall be 1/2" steel plate with neoprene weather seal, has 3-point locking and heavy stainless steel lock cover.
   b. Housing shall be 100% welded 1/4" plate steel.
   c. Finish shall be Aluminum polyester powder coat with undercoat primer.

H. "Unistrut" Support System:
1. UNISTRUT CHANNEL SYSTEM - The metal framing shall be by UNISTRUT CORPORATION or approved equivalent. Provide Model #P 5500 (and #P 3300SL - Stainless Steel) channels or as noted on the Drawings. Channels shall be 1-5/8" wide with 7/8" continuous slot opening and with in-turned edges to engage spring mounted gripping nuts. Nuts shall be made of hardened steel with serrated grooves to prevent longitudinal movement. Fittings shall be accurately formed from 1/4" thick steel. Channels and fittings shall be cleaned, phosphated and coated with a rust inhibiting custom color enamel paint. Hardware shall be zinc plated in accordance with ASTM B 633 “Specification for Electrodeposited Coatings of Zinc on Iron and Steel• , Type SC-1.
2. Materials used in the manufacture of framing components shall be in accordance with the following:
   a. Channel Members in accordance with ASTM A 1011 “Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength• ,SS Grade 33.
   b. Fittings in accordance with ASTM A 575 “Specification for Steel Bars, Carbon, Merchant Quality, M-Grades”.
   c. Fitting Steel conforms to ASTM A 1011 “Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength”, SS Grade 33.
   d. Channel Nuts in accordance with ASTM A 675 “Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties”, Grade 60.
   e. Bolts in accordance with ASTM A 1011 “Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength• ,SS Grade 33.
   f. Screws, SAE J429 Grade 2, and ASTM A 307 “Specification for Carbon Steel Bolts and Standards, 60,000 PSI Tensile Strength”.
3. All Nuts and Bolts 1/2 inch in diameter and greater shall be torqued to a minimum of 50 ft-lbs each.

I. Vinyl Window Film
1. Provide and install where indicated on drawings LLUMAR Vinyl Window Film as manufactured by EASTMAN Chemical company
   a. Model #RN07G SR CDF (One-Way Mirror) in the Reflective Series
   b. Visible Light Transmittance: 5%

c. Visible Reflectance (exterior): 60%
d. Visible Reflectance (interior): 14%

2. Install per manufacturers recommendation utilizing a water-activated, dry-adhesive system

END OF SECTION

SECTION 10 11 00 – VISUAL DISPLAY BOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to furnish and install Visual display boards and Tackboards, Accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 04 22 00 CONCRETE MASONRY UNITS
   4. 05 12 00 STEEL AND FABRICATIONS
   5. 06 10 00 ROUGH CARPENTRY
   6. 09 22 16 METAL FRAMING
   7. 09 24 00 CEMENT PLASTER
   8. 09 29 00 GYPSUM BOARD
   9. 09 72 00 WALL COVERINGS
   10. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Samples:
      a. Submit one sample each of Manufacturer's standard finish colors (including standard, premium and custom colors).

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. In accordance with Specification Section REGULATORY REQUIREMENTS, and the following:
      a. AIES American and Illuminating Engineering Society.

1.4 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written standard warranty:
      a. Warranty Period One (1) Year.

C. Installer's Warranty:
   1. In accordance with the terms of the Specification Section - WARRANTIES:
      a. Warranty period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process

due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified Liquid Marker Board Panel product manufacturers, or approved equivalent:
   a. EGAN VISUAL "Dimension 13 " - Model #DM13-7248
   b. EGAN VISUAL Marker Tray ACD.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES

2.2 MATERIALS

A. Liquid Marker Board Panels ("Dimension 13")
1. "EVS" surface, steel substrate, dry erase and projection capable, and can accept standard magnetic accessories, with a White Edge, with mounting cleats included.
   a. Provide "Flush Finish" for Left or Right End Panels.
   b. Provide standard two (2) assorted color Dry-Erase Markers and one (1) "EganCloth".
2. Size: 72" w x 48" h x 1/2" d, with White Edges
3. Orientation of the installed board panel: As indicated on the drawings.
4. Accessories:
   a. Magnetic Marker Tray: One for each Board.

2.3 FABRICATION

A. Laminate facing sheet and backing sheet to core material under pressure with manufacturer's written recommended flexible, waterproof adhesive.
B. Assembly: Provide factory-assembled visual display board units except where filed-assembled units are required.
1. Make joints only where total length exceeds maximum manufactured length. Fabricate with the minimum number of joints, balanced around the center of ht board, as acceptable to the Architect.
2. Provide the manufacturer's standard vertical joint system between abutting sections of display boards.
C. Minimum lengths shall be 16 feet, in one piece, or as indicated on Drawings.
D. Fabricate "Horizontal Sliding Markerboards" as indicated on the drawings in accordance with manufacturer's written recommendations.

2.4 FINISHES

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Deliver factory-built visual display board units completely assembled in one piece without joints, wherever possible. Where dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to the Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.
B. Install units in locations and at mounting heights indicated and in accordance with the manufacturer's written instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for a complete installation.
C. Coordinate with other sections for metal or wood backing.
1. Contractor to coordinate all blocking required for sizes indicated on Drawings prior to enclosing stud cavities.

D. Install boards top and bottom with wall clips screwed to backing at 24 inches on center at blocking.

3.2 ADJUSTING

A. Verify that accessories required for each unit have been properly installed and that operating units function properly.

3.3 CLEANING

A. Clean units in accordance with the manufacturer's written instructions.

END OF SECTION

SECTION 10 14 00 – IDENTIFYING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all Identifying Devices Plastic Signs, Acrylic Signs and Decals, materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 30 00 CAST-IN-PLACE CONCRETE
4. 04 22 00 CONCRETE MASONRY UNITS
5. 06 10 00 ROUGH CARPENTRY
6. 08 11 00 METAL DOORS AND FRAMES
7. 08 14 16 WOOD DOORS
8. 08 34 73 ACOUSTICAL DOORS AND FRAMES
9. 08 80 00 GLASS
10. 09 22 16 METAL FRAMING
11. 09 24 00 CEMENT PLASTER
12. 09 26 13 VENEER PLASTER
13. 09 29 00 GYPSUM BOARD
14. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
15. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 DEFINITIONS

C. Definitions pertaining to signage are as follows:

1. Characters Shall mean all letters, numbers, symbols or pictograms.

1.3 SYSTEM DESCRIPTION

D. Design Requirements for Tactile Signage:

1. Characters and Graphics:
   a. Finish and Contrast: Characters and their background shall have a non-glare finish. Characters shall contrast with their background, either light characters on a dark background or dark characters on a light background – CBC Section 11B-703.5.1, 11B-703.6.2, and 11B-703.7.1.
   b. Character Type: Characters on signs shall be raised 1/32 inch (0.794 mm) minimum and letters and numbers shall be sans serif uppercase characters accompanied by contracted (Grade 2) Braille complying with CBC Section 11B-703.3 and Table 11B-703.3.1.
   c. Character Size: Raised characters (letters and numbers) shall be a minimum of 5/8 inch (15.9 mm) and a maximum of 2 inches (51 mm) high.
   d. Pictorial symbol signs (pictograms): Pictorial symbol signs (pictograms) shall be accompanied by the verbal description placed directly below the pictogram. the outside dimension of the pictogram field shall be a minimum of 6 inches (152 mm) in height.
   e. Character Placement: Characters and Braille shall be in a horizontal format. Braille shall be placed a minimum of 3/8 inch (9.5 mm) and a maximum of 1/2 inch (12.7 mm) directly below the tactile characters; flush left or centered. When tactile text is multilined, all Braille shall be placed together below all lines of tactile text.

f. Proportions: Raised characters on signs shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase letter "I." Stroke thickness of the uppercase "I" shall be 15 percent maximum of the height of the character.
   1) For Braille Text, capitalization shall conform to CBC Section 11B-703.3.1.

2. Braille:
   a. California Contracted Grade 2 Braille shall be used wherever Braille is required in other portions of these standards. Braille shall accompany all raised characters – CBC Section 11B-703.3 and Table 11B-703.3.1.
      1) Dots shall be rounded or domed.
      2) Below measured as a minimum in inches and maximum in inches:
      3) Dot Base Diameter: 0.059 (1.5 mm) to 0.063 (1.6 mm).
      4) Distance between two dots in the same cell (measured center-to-center): 0.100 (2.5 mm).
      5) Distance between corresponding dots in adjacent cells (measured center-to-center): 0.300 (7.6 mm).
      6) Dot Height: 0.025 (0.6 mm) to 0.037 (0.9 mm).
      7) Distance between corresponding dots from one cell directly below:
         a) 0.395 (10 mm) to 0.400 (10.2 mm).

3. Signs shall be installed on the wall adjacent to the latch side of the door.
   a. Where there is no space on the latch side, including at double leaf doors, signs shall be placed on the nearest adjacent wall, preferably on the right.
   b. Mounting height shall be as indicated in details on the drawings and in compliance with 11B-703.4.1 and 11B-703.4.2.

4. Inspection: Signage shall be field inspected after installation per CBC 11B-703.1.1.2.

E. Performance Requirements: It is the intention of this specification section and the drawings to form a guide for a complete, operable system signage system that is compliant with State and Federal Accessibility Regulations. Any items not specifically noted but necessary for a complete, operable and accessible system shall be provided under this section.

1.4 SUBMITTALS

F. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Product Data.
   a. Submit manufacturer's full color range (including any standard, premium and custom colors) for selection by the Architect within thirty days of receipt of the NOTICE TO PROCEED.
      1) Provide actual 2-inch x 2-inch sample colors and patterns available from the manufacturers for color selection.

2. Shop Drawings.
   a. Submit shop drawings showing fabrication and installation of the work of this section including plans, elevations, sections, details of components, and attachments to other units of work, including accessibility dimensions for mounting heights.
   b. Submit drawings indicating Room numbers shown on the Contract Documents coordinated with Owner's Room Numbers.

3. Samples.
   a. Provide actual 2-inch x 2-inch sample of each sign type specified.

4. Quality Assurance/Control Submittals:
   a. Certificates:
      1) Submit four (4) copies of certificates.

2) Upon completion of the installation, submit a Certificate from the Contractor (on the Contractor's Letterhead) and co-endorsed by the manufacturer/supplier, sub-contractor/installer that the signage supplied for this project requiring braille complies with the California Contracted Grade 2 Braille and the CBC Section 11B-703.3.
   a) Those attesting to the compliance certificate above shall also acknowledge that they are aware of the Submission Under Penalty Of Perjury per California Government Code Section 12650, et seq, pertaining to false claims, and further know and understand that submission of certification of a false claim may lead to fines, imprisonment and/or other severe legal consequences.

b. Manufacturer's Instructions:
   1) Submit three (3) copies of manufacturer's instructions.

5. Closeout Submittals in accordance with the following:
   a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
   b. Record Documents in accordance with Specification Section - RECORD DOCUMENTS.
   c. Warranty in accordance with Specification Section - WARRANTIES and this section.

1.5 QUALITY ASSURANCE

G. Qualifications:
   1. Installer Qualifications:
      a. Engage an experienced Installer who has been approved by the manufacturer.
   2. Manufacturer's/Supplier's Qualifications:
      a. Firm's experienced in successfully producing/supplying products similar to those indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

H. Regulatory Requirements:
   1. In accordance with Specification Section - Regulatory Requirements, and the following:
      a. ADA Americans with Disabilities Act of 1990.
      b. CBC California Building Code - California Contracted Grade 2 Braille when required.
   2. Inspection: Tactile signs shall be field inspected for compliance after installation (11B-703.1.1.2).

1.6 DELIVERY, STORAGE, AND HANDLING

I. Packing, shipping, handling, and unloading:
   1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

J. Acceptance at Site:
   1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
   2. Damaged products will not be accepted.

K. Storage and protection:
   1. Products shall be stored in a dry, protected area.
   2. Products shall be stored in locked storage building.

1.7 WARRANTY

L. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

M. Manufacturer's Warranty:
   1. In accordance with manufacturer's written standard warranty:

a. Warranty Period One (1) Year.

N. Installer's Warranty:

1. In accordance with the terms of the Specification Section - WARRANTIES:

a. Warranty period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

O. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Metal Signs:
   a. KING ARCHITECTURAL PRODUCTS. “KMS Modular Signs”.
2. Plastic Signs:
   a. MOHAWK SIGN SYSTEMS.
   b. Acceptable alternative manufacturer:
      1) BEST MANUFACTURING COMPANY.
3. Decals:
   a. SETON NAME PLATE COMPANY.

P. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

Q. Metal Signs:

1. Exterior:
   a. Extruded aluminum signs with a bonded zinc plate having bonded zinc characters, graphics or Braille dots, capable of handling high heat conditions up to 150 degrees facing due West. Front Plate shall be interchangeable. Front Plate and Back Plate shall have interlocking dovetails with locking strip inserts, and vandal resistant 4-40 “allen” set screw for secure application.
      1) Characters and Pictograms/Symbols:
         a) Style: Helvetica Regular upper case.
         b) Tactile: Raised 1/32” from sign face.
         c) Braille: California Contracted Grade 2 located below lettering.
      2) Perimeter:
         a) Style: 6 mm square fastening profile top and bottom.
         b) Corners: Square.

R. Plastic Signs:

1. Interior / Exterior:
   a. MP (Melamine Plastic) both sides with contrasting phenolic resin core color. The MP shall be scratch resistant, non-static, fire retardant, washable melamine surface laminate with a non-glare surface with artwork and graphics carved into the face surface.
   b. Performance Requirements:
      1) Weight: 1 lb./sq. Ft.
      2) Maximum Continuous Operating Temperature: -225 degrees F.
      3) Flexural Strength Flat: 25,000 psi.
      4) Tensile Strength: 22,000 psi.
      5) Compressive Strength Flat: 47,000 psi.
      6) Shear Strength: 16,800 psi.

7) Dielectric Strength Short Time: 330 Volts/Mil.
   a) Per ASTM D 229 "Sheet Plate Electrical Insulation Testing Equipment / Test Resources."
8) NEMA rating: "Self-extinguishing."

c. Mylar, Photopolymers and Polymer Materials are not allowed.
d. "Sand Carved" MP plates (including phenolic core):
   1) Characters and Pictograms/Symbols:
      a) Style: Tactile Helvetica Regular upper case.
      b) Tactile: Raised 1/32" from sign face.
      c) Braille: California Contracted Grade 2 located below characters:
      d) Style: Framed.
      e) Corners: Square.
   2) Thickness: Approximately 1/8 inch thick.
e. Frame and back-up (mounting) plates:
   1) Interior Plastic Frames and back-up plates:
      a) High Impact Plastic Styrene frames.
      b) Back-up plates shall be manufacturer's standard 1/8" thick melamine plastic laminate, suitable for interior use only and mechanical attachment to substrates.
      c) Corner Style: Square.
      d) Size: 1/2" deep x 1/8" thick walls.
      e) Reveal: 3/32", black color.
   2) Aluminum Frames and back-up plates:
      a) Extruded aluminum angle.
      b) Back-up plates shall be manufacturer's standard 1/8" thick MP Plates suitable for exterior [**and interior**] use, and mechanical attachment to substrates.
      c) Corner Style: Square.
      d) Size: 1/2" deep x 1/16" thick walls.
      e) Reveal: 3/32", black color.

S. Decals:
   1. Provide outdoor grade permanent vinyl material with die cut graphics, characters and self-adhesive back for bonding to clean, smooth surfaces.

2.3 ACCESSORIES

T. Fasteners:
   1. Concealed Attachment: Provide appropriate flathead countersunk stainless steel screws for the substrate backing in which the sign is to be applied.
   2. Exposed Attachment – provide appropriate tamper resistant, flathead countersunk stainless steel screws with grommet finish washers for the substrate backing in which the sign is to be applied.
   3. Adhesive: "Silastic Adhesive."
   4. Foam Tape: SCOTCH MOUNT FOAM TAPE.

2.4 FABRICATION

U. Shop Assembly:
   1. Braille Compliance:
      a. See Part 1 of this specification – SYSTEM DESCRIPTION, and comply with the "Design Requirements for Tactile Signage" • that requires California Contracted Grade 2 Braille.
   2. Metal Signs:
      a. Extrude the Interlocking Metal Signs and backing plates to the sizes and profiles as indicated. Provide bonded plates, graphics, characters and California Contracted Grade 2 Braille Text when required, and assembling all the components and

finishing in accordance to the specifications. All components of the signage system shall be ready to install in the field.

3. Plastic Signs:
   a. Fabricate the plastic signs and backing plates, and then "Sand Carve" the MP plates in accordance with the manufacturer's recommendations and as indicated. Comply with ADA requirement for symbols and California Contracted Grade 2 Braille characters when required, and finish in accordance to the specifications. All components of the signage system shall be ready to install in the field.

2.5 FINISHES

V. Metal Signs:
   1. Sign profiles shall be anodized with baked-on acrylic polyurethane matte finish, color as selected by the Architects from the manufacturer's full color line, including any custom colors
   2. Allow for two color application- one color for the field, top and bottom rails, and one color for the characters.

W. Plastic Signs:
   1. Finish: Non-glare, face and core as selected by the Architect from the manufacturer's full color line, including any custom colors form complying with the requirements for contrasting colors of field to Symbols and Braille Text.
   2. Allow for two color application without the frame – one color for the field, top and bottom rails, and one color for the characters.

X. Decals:
   1. Integral non-glare finish from outdoor vinyl and die cut vinyl graphics, characters, in contrasting colors as selected by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

Y. Site verification of conditions:
   1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual which affect the execution of work under this specification section.
   2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
   3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

Z. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work specified under this specification section.
   2. Contractor to provide internal wall blocking for all attached identifying devices.

AA. Protection:
   1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

BB. Surface preparation:
   1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
   2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

3.3 INSTALLATION

CC. General:

1. In accordance with manufacturer's written instruction and recommendations unless specifically noted otherwise.
2. In accordance with approved Submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.

DD. Layout:
1. Lines of all signs shall be straight and true.
2. Set plumb, level, and square.
3. Temporary positioning with foam tape.

EE. Metal Signs:
1. “Blind” screw the back-up plate with four (4) flathead countersunk screws as not to interfere with the signs interlocking mechanism. No tape attachment is allowed.
2. Front Plate and Back Plate shall have interlocking dovetails with locking strip inserts, and vandal resistant 4-40 “allen” set screw for secure application.

FF. Plastic Signs:
1. "Blind" screw the back-up plate with four (4) flathead countersunk screws (minimum) so as not to interfere with face plate. Tape attachment is not allowed.
2. Anchor face plate to back-up plate with Silastic Adhesive for permanent attachment.
3. Seal all exposed edges at exterior conditions with compatible sealant, same color as sign back-up plate.

GG. Mounting Conditions:
1. Metal Stud Framed Wall: Provide solid metal backing, attached to studs, adequate for fastening at all corners of sign.
2. Wood Stud Framed Wall: Provide solid wood backing, attached to studs, adequate for fastening at all corners of sign.
3. Concrete and Concrete Masonry: Provide drilled 1/4" diameter concrete or concrete masonry stainless steel anchors at all corner s of signs.
4. Glass: Provide "Silastic Adhesive" for permanent attachment of back-up plate. Provide blank plate of same material and size as the sign itself. Place on opposite side of glass and aligned with sign. Color as selected by the Architect.
5. Door: Fasten to door with tamper resistant flathead countersunk screws, minimum three (3) stainless steel screws with grommet finish washers per sign.

3.4 FIELD QUALITY CONTROL

HH. Site Tests:
1. As required by Regulatory Requirements.

3.5 CLEANING

II. Clean in accordance with Specification Sections - TEMPORARY FACILITIES AND CONTROLS and PROJECT CLOSEOUT.
1. Leave area level and free of any ruts or debris. Appearance of earth surface shall be equal to or better than adjacent undisturbed surfaces.
2. Clean any soiled surfaces at the end of each day, minimum.
3. Finish shall be clean and ready for the application of any additional finishes.
4. In accordance with manufacturer's written instructions and recommendations.

3.6 PROTECTION

JJ. Protection from traffic:
1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

3.7 SCHEDULES

KK. General:

1. All signs with text shall have California Contracted Grade 2 Braille unless otherwise noted.
2. Refer to Plumbing drawings for number and approximate location for "Gas Valve" signs. Signs shall be mounted +2" above Finished Floor.
3. Refer to drawings for various backing requirements.

LL. Sign Material:

1. EM = Exterior Metal.
2. IM = Interior Metal.
3. EP = Exterior Plastic.
4. IP = Interior Plastic.
5. A = Acrylic
6. D = Decal.

MM. Mounting Condition:

1. 1 = Metal Stud Framed Wall.
2. 2 = Wood Stud Framed Wall.
3. 3 = Concrete or Concrete Masonry.
4. 4 = Glass.
5. 5 = Door Mounted.

NN. Sign Types:

1. Sign Type 1 - Accessibility Entrance:
   a. 7"H x 7" L nominal square shape.
      1) 6" high non-Tactile International Symbol of Accessibility required.
      2) No Text or Braille required.
2. Sign Type 2 - Toilet Room:
   a. 3.5" H x 7" L nominal rectangular shape.
      1) 3/4" high Tactile Text.
         a) "XXXXXX" and "RESTROOM".
      2) Braille required.
   b. 12" diameter nominal circular shape ("FEMALE").
      1) No Text or Braille required.
   c. Equilateral triangle shape edges 12" L with vertex upward ("MALE").
      1) No Text or Braille required.
   d. Equilateral triangle shape, superimposed within 12" diameter nominal circular shape ("UNISEX").
      1) No Text or Braille required.
3. Sign Type 3 - Occupancy Load:
   a. 7" h x 15" L nominal rectangular shape.
      1) 3/4" high non-Tactile Text required.
         a) "THE NUMBER OF PEOPLE PERMITTED IN THIS ROOM SHALL NOT EXCEED "XXX" BY ORDER OF THE STATE FIRE MARSHAL"
      2) No Braille required.
   b. 7" h x 15" L nominal rectangular shape.
      1) 3/4" high non-Tactile Text required.
         a) "THE NUMBER OF PEOPLE PERMITTED IN THIS ROOM SHALL NOT EXCEED "XXX" FOR DINING OR "XXX" FOR ASSEMBLY BY ORDER OF THE STATE FIRE MARSHAL"
      2) No Braille required.
4. Sign Type 4 - Assistive Listening:
   a. 7"H x 15"L nominal square shape.
      1) 6" high tactile International Symbol of Access for Hearing Loss required.
      2) 5/8" high Tactile Text required.
      3) No Braille required.
5. Sign Type 5 - Room Identification:

a. 7" H x 7" L nominal square shape.
   1) 2" high Tactile Text required.
   2) Braille required.
b. 3 1/2" H x 15" L nominal rectangular shape.
   1) 2" high Tactile Text required.
   2) Braille required.
c. 11" H x 15"L nominal rectangular shape.
   1) 2" high Tactile Text required.
   2) Braille required.

6. Sign Type 6 - Tactile Identification:
   a. 3-1/2"H x 7"L nominal rectangular shape.
      1) 3/4" high Tactile Text required.
      2) Braille required.
   b. 3-1/2"H x 15"L nominal rectangular shape.
      1) 3/4" high Tactile Text required.
      2) Braille required.
   c. 7"H x 7"L nominal square shape.
      1) 3/4" high Tactile Text required.
      2) Braille required.
   d. 7"H x 15"L nominal rectangular shape.
      1) 3/4" high Tactile Text required.
      2) Braille required.
7. Sign Type 7 - Non-Tactile Identification:
   a. 3-1/2"H x 7"L nominal rectangular shape.
      1) 3/4" high Non-Tactile Text required.
      2) No Braille required.
   b. 3-1/2"H x 15"L nominal rectangular shape.
      1) 3/4" high Non-Tactile Text required.
      2) No Braille required.
   c. 7"H x 7"L nominal square shape.
      1) 3/4" high Non-Tactile Text required.
      2) No Braille required.
   d. 7"H x 15"L nominal rectangular shape.
      1) 3/4" high Non-Tactile Text required.
      2) No Braille required.
8. Sign Type 8 - Directional:
   a. 3-1/2" H x 15" L nominal rectangular shape.
      1) Tactile Arrow symbol(s).
      2) 3/4" high Tactile Text.
      3) Braille required.
   b. 7" H x 15" L nominal rectangular shape.
      1) Tactile Arrow symbol(s).
      2) 3/4" high Tactile Text.
      3) Braille required.
   c. 11" H x 15" L nominal rectangular shape.
      1) Tactile Arrow symbol(s).
      2) 3/4" high Tactile Text.
      3) Braille required.
   d. 15" H x 15" L nominal square shape.
      1) Tactile Arrow symbol(s).
      2) 3/4" high Tactile Text.
      3) Braille required.
9. Sign Type 9 - Area of Refuge:

a. 11" H x 7" L nominal rectangular shape.
   1) 5/8" high Tactile Text required.
   2) Braille required.
   3) 6" high Non-Tactile International Symbol of Accessibility.

10. Sign Type 11- Fire Riser Identification
    a. 12” x 18”, 2” High letters that read “FIRE RISER ROOM INSIDE”.
    b. Lettering shall be white reflectorized characters on a red background.

END OF SECTION

SECTION 10 14 53 – ROAD AND PARKING SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all walk, road and parking signage materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 30 00 CAST-IN-PLACE CONCRETE
4. 32 12 00 PAVEMENT
5. 32 31 13 CHAIN LINK
6. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
7. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Product Data.
   a. Submit manufacturer's full color range (including any standard, premium and custom colors) for selection by the Architect and Civil Engineer.
2. Shop Drawings.
   a. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, the loading, required clearances, method of field assembly, components, and location and size of each field connection.
   b. Closeout Submittals in accordance with Specification Sections in Division One.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications:
   a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
2. Manufacturer/Supplier Qualifications:
   a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
   a. ADA Americans with Disabilities Act.
   b. CBC California Building Code, all accessible parking signage shall be as required by CBC 11B-502.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:

1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:

1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
2. Damaged products will not be accepted.

C. Storage and protection:

1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
    a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.5 PROJECT CONDITIONS

A. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

1.6 WARRANTY

A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:

1. In accordance with manufacturer's written standard warranty:
    a. Warranty Period One (1) Year.

C. Installer's Warranty:

1. In accordance with the terms of the Specification Section - WARRANTIES:
    a. Warranty Period One (1) Year.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Signage material:

1. Signs shall be permanent and reflectorized, constructed of porcelain coating on steel with beaded text or approved equivalent.
2. Sign materials shall be hot-dipped galvanized, embossed steel, with a heavy-duty baked enamel finish.
    a. 16 gage steel for all signs larger than 24" x 24".
    b. 18 gage steel for all signs smaller than 24" x 24".

B. Brackets:

1. Galvanized Pipe, attached with vandal resistant fasteners.
    a. Provide Owner with tool that is compatible with vandal resistant fasteners so that maintenance can be performed on the signs.

C. Posts:

1. Pipe, galvanized, Schedule 40, in accordance with ASTM A 53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless," with compatible galvanized Dome Caps.

D. Concrete:

1. See Specification Section – CAST-IN-PLACE CONCRETE.

E. Other Materials:

1. Materials not specifically indicated but needed for proper installation shall be new and of first quality as selected by contractor subject to review by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 INSTALLATION

A. General:

1. In accordance with Regulatory Requirements.
2. Set plumb, level, and square.
    a. Set post plumb and at proper height.
    b. Place concrete and tamp to assure consolidation.
        1) Footings shall be 8" in diameter, 24 inches deep minimum, unless otherwise noted.
        2) Top of concrete shall be 3-1/2 inches below finished grade.
    c. Install brackets so signs are plumb and level.
    d. The accessible signage shall be centered at the interior end of the parking space at a minimum height of 80 inches from the bottom of the sign to the parking space finished grade, ground or sidewalk.
        1) In lieu of posts, the accessible parking space signage may also be centered on the wall at the interior end of the parking space (if applicable) at a minimum of 60 inches from the parking space finished grade, ground or sidewalk. Verify with Architect before using this option.

3.3 SCHEDULE

A. Parking Entrance Accessible Sign:

1. A sign shall be posted in a conspicuous place at each entrance to off-street parking facilities.
2. Size: 17" x 22" minimum.
3. Lettering: 1" high minimum.
4. Text: "Unauthorized vehicles parked in designated accessible spaces not displaying distinguishing placards or special license plates issued for persons with disabilities will be towed away at owner's expense. Towed vehicles may be reclaimed at <insert location> or by telephoning <insert contact information>.

a. Owner of Project to provide information as a permanent part of the sign. Sign provider to verify information needed with Owner prior to fabrication.

B. Parking Stall Accessible Sign:

1. Background: blue reflectorized.
2. Lettering: 1" high minimum, white reflectorized.
3. Symbol: International Symbol of Accessibility.
4. Text: MINIMUM FINE $250
5. Add van accessible sign to the parking space identified on the contract drawings.
   a. Text: VAN ACCESSIBLE

C. Stop Sign: in accordance with traffic standards in the area where the project is located.

1. Size & shape: 18" x 18" octagon.
2. Background: red.
3. Lettering: 6" high minimum, white reflectorized.
4. Text: STOP

D. Fire Riser Room Route Sign:

1. Size: 12" x 18".
2. Background: red.
3. Lettering: 1-1/2" high, white reflectorized.
4. Text: FIRE RISER ROOM ROUTE

END OF SECTION

SECTION 10 26 00 – WALL AND CORNER GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all Wall and Corner Guard materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 08 11 00 METAL DOORS AND FRAMES
   4.
   5. 08 15 13 LAMINATE-FACED WOOD DOORS
   6. 08 34 73 ACOUSTICAL DOORS AND FRAMES
   7. 09 24 00 CEMENT PLASTER
   8. 09 29 00 GYPSUM BOARD
   9. 09 72 00 WALL COVERINGS
   10. 09 91 00 PAINTING
   11. 10 05 00 MISCELLANEOUS SPECIALTIES
   12. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with the following standards:
      a. ASTM American Society of Testing Materials
      b. NFPA National Fire Protection Association

1.3 SYSTEM DESCRIPTION

A. Design Requirements: In accordance with allowable values and properties assigned and approved by CBC.

B. Performance Requirements: It is the intention of this section and the drawings to form a guide for a complete and operable system. Any items not specifically noted but necessary for a complete and operable system shall be provided under this section.
   1. Fire Performance Characteristics.
      a. Class A under ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials":
         1) Flame Spread: 25 or less.
         2) Smoke Developed: 450 or less.
   2. Impact Strength:
      a. Provide rigid sheet materials that have an Impact Strength of 30.4 ft-lbs/inch of thickness as tested in accordance with the procedures specified in ASTM D 256 "Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics."
   3. Chemical and Stain Resistance
      a. Provide wall protection system components with chemical and stain resistance in accordance with ASTM D 543 "Practices for Evaluating the Resistance of Plastics to Chemical Reagents."
   4. Fungal and Bacterial Resistance:
      a. Provide material that does not support fungal or bacterial growth as tested in accordance with ASTM G 21 "Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi."

5. Color Consistency:
    a. Provide components matched in accordance with SAE J-1545 – (Delta E) with a color difference no greater than 1.0 units using CIE Lab, CIE CMC, CIE LCh, Hunter Lab or similar color space scale systems.
6. Accessibility Compliance:
    a. Comply with ADA requirements and requirements of ANSI A117.1.

1.4 SUBMITTALS

A. Submit in accordance with Project Manual Specification Section - SUBMITTAL PROCEDURES:
    1. Coordination Drawings:
        a. Submit installer's coordination drawings indicating the work of this section with that of related work of other sections for proper interface of the completed work. Installer shall coordinate and obtain approvals from the work of other related sections prior to submitting to the Architect.
    2. Product Data.
        a. Submit manufacturer's full color range (including any standard, premium and custom colors) for selection by the Architect.
            1) Provide data for each type of rigid vinyl kickplates specified.
    3. Shop Drawings.
        a. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loading, required clearances, method of field assembly, components, and location and size of each field connection.
    4. Samples.
        a. Provide 8" square sample of each color and pattern selected.
        b. Provide 6 inch lineal samples of each piece of trim material specified.
    5. Closeout Submittals in accordance with Project Manual Division 1 Sections:
        a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
        b. Project Record Documents in accordance with Specification Section - PROJECT RECORD Documents.
        c. Warranty in accordance with Specification Section - WARRANTIES.

1.5 QUALITY ASSURANCE

A. Qualifications:
    1. Installer Qualifications:
        a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
B. Regulatory Requirements:
    1. In accordance with Project Manual Specification Section - REGULATORY REQUIREMENTS, and the following:
        a. ADA Americans with Disabilities Act of 1990.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
    1. Products shall be individually wrapped.
    2. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.
B. Acceptance at Site:
    1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
    2. Damaged products will not be accepted.
C. Storage and protection:
    1. Products shall be stored in a dry, protected area.

1.7 PROJECT CONDITIONS

A. Environmental requirements:
   1. Temperature: acclimate products in environment between sixty-five (65) degrees Fahrenheit and seventy (70) degrees Fahrenheit for one (1) day prior to installation.

B. Existing Conditions:
   1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

1.8 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written standard warranty:
      a. Warranty Period One (1) Year.

C. Installer's Warranty:
   1. In accordance with the terms of the Specification Section - WARRANTIES:
      a. Warranty period [One (1) Year.]

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
   1. Specified product manufacturer, or approved equivalent:
      a. INPRO CORPORATION
      b. KOROSEAL (Division of RJF INTERNATIONAL CORPORATION)
      c. Acceptable alternative manufacturers:
         1) ACROVYN as manufactured by The C/S GROUP
         2) KOROSEAL (Division of RJF INTERNATIONAL CORPORATION)

B. Products from other manufacturers not listed must submit in accordance with Project Manual Specification Section - SUBSTITUTION PROCEDURES.

2.2 MANUFACTURED UNITS

A. Corner Guards:
   1. Vinyl/Acrylic Flush Corner Guards:
      a. INPRO Model # 160 (2 inch x 2 inch x 8 feet):
         1) When wall height exceeds maximum length available (12 feet), splice to be placed near the ceiling at the highest point practical for full height installation.
         2) Provide manufacturer's standard Vinyl/Acrylic extrusions in a nominal wall thickness of 0.080".
         3) Finish to be manufacturer's matte "Pebblette" finish in color as selected by Architect from manufacturer's full color range.
         4) Chemical and stain resistance shall be in accordance CSAV-280 standards, established by the manufacturer.

5) Provide continuous aluminum retainer 0.070" nominal thickness including attachment of hardware for a complete assembly.\

B. High Impact Wall Covering:
1. High Impact Wall Covering:
a. INPRO "Rigid Vinyl Sheet" Item protective wall covering panels in sizes indicated on the drawings.
1) Provide manufacturer's standard vinyl/ acrylic extrusions in a nominal wall thickness of 0.060".
2) Provide manufacturer's recommended adhesive for the substrate material indicated on the drawings.
3) Finish to be manufacturer's matte "Pebblette" finish in color as selected by Architect. Refer to Interior Color Schedule.
4) Provide the manufacturer's recommended trim pieces and fabricated configurations as required by the drawings.

2.3 COMPONENTS
A. End caps, outside corners and inside corners shall be made of injection molded thermoplastics.
1. Joints:
a. Inside Corners: Color to match wall protection.
b. Joint Sealants: Color to match wall protection.

2.4 ACCESSORIES
A. All mounting system accessories appropriate for substrates indicated on the drawings shall be provided.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual, which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 INSTALLATION
A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
a. Provide continuous blocking in walls of similar materials as the wall construction to properly anchor the continuous handrail system at the height indicated on the drawings. Fasteners shall be placed at 32" o.c. maximum.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.
B. Minimum temperature requirements for all products must be +70 deg. F. Relative humidity shall not exceed 80 percent.
C. Layout:
1. Lines shall be straight and true.

3.3 CLEANING
A. Clean in accordance with Project Manual Specification Section - PROJECT CLOSEOUT.

1. Clean any soiled surfaces immediately.
2. Clean any soiled surfaces at the end of each day, minimum.
3. In accordance with manufacturer's written instructions and recommendations.

END OF SECTION

SECTION 10 28 13 – TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Furnish all material, labor, equipment and services necessary to furnish Toilet Accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 04 22 00 CONCRETE MASONRY UNITS
4. 06 10 00 ROUGH CARPENTRY
5. 08 80 00 GLASS
6. 09 24 00 CEMENT PLASTER
7. 09 29 00 GYPSUM BOARD
8. 09 30 00 TILE
9. 09 72 00 WALL COVERINGS
10. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Product Data.
2. Shop Drawings.
   a. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loading, required clearances, method of field assembly, components, and location (including ADA Required dimensions for mounting locations), and size of each field connection.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
   a. ADA American's with Disabilities Act 1990.
   b. ANSI American National Standards Institute Specifications ANSI A117.1 "Accessible and Usable Buildings and Facilities".
   c. CBC California Building Code (California State Building Standards Code - Title 24) and the latest edition of DSA's California Access Compliance Advisory Reference Manual.

1.4 WARRANTY

A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:

1. In accordance with manufacturer's written standard warranty:
   a. Warranty Period One (1) Year.

C. Installer's Warranty:

1. In accordance with the terms of the Specification Section - WARRANTIES:
   a. Warranty period Five (5) years.

PART 2 - PRODUCTS

A. See Schedule in PART 3.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All Toilet Room Accessories shall be furnished and installed by the Contractor, in accordance with manufacturer's written recommendations, and in accordance with accessibility mounting height.

B. Install in accordance with CBC and ADA Accessibility Chapters and Sections, and ANSI A 117.1.

3.2 SCHEDULES

A. All devices listed herein shall be installed where shown, complete, and ready for use in full compliance with all applicable codes and standards. The manufacturers listed are acceptable as approved suppliers to the Owner. Substitution of manufacturers other than those listed, must be approved by the Owner.

1. Paper Towel Dispenser:
   a. Surface mounted, manual operation, satin finish stainless steel. Dispenses 400 c-fold or 525 multi-fold paper towels. Door has tumbler lock and piano hinge. Dimensions: 10 3/4 inches wide, 14 inches high, 4 inches deep. Provide manufacturer's accessory to facilitate single-towel dispensing.
      1) Acceptable Manufacturers:
         a) BOBRICK B-262 (Classic Series) with 262-130 "TowelMate."
2. Soap Dispenser:
   a. Surface mounted, manual operation, satin finish type-316 stainless steel. Capacity of 40 fl oz liquid soap or antibacterial soap. Locked hinged stainless steel lid is located on top for refilling. Refill-indicator window is located on front. Black molded plastic push button dispenses soap. Dimensions: 4-3/4 inches high, 8-1/8 inches wide, 3-1/2 inches deep.
      1) Acceptable Manufacturers:
         a) BOBRICK B-2111 (Classic Series).
3. Seat Cover Dispenser:
   a. Surface mounted, satin finish type-304 22-gage stainless steel. Capacity of 250 toilet seat covers or one box. Dispenser fills from bottom through concealed opening. Ensure 5 inches minimum clearance from bottom of dispenser to top of any horizontal projection to provide room for filling dispenser from bottom.
      1) Acceptable Manufacturers:
         a) BOBRICK B-221 (Classic Series).
         b) BRADLEY 5831.
4. Toilet Tissue Dispenser :
   a. Accessible Stalls: Recessed multi-roll toilet tissue dispenser shall be Type 304, 22 gage stainless steel with all-welded construction; exposed surfaces shall have satin finish.
      1) The front of toilet tissue dispenser shall be drawn, one-piece, seamless construction. Door shall be secured to cabinet with two rivets and equipped with a tumbler lock keyed like other manufacturer's washroom accessories.
      2) Flange shall be drawn, one-piece, seamless construction. Unit shall dispense two standard-core toilet tissue rolls up to 5-1/4" diameter.
      3) Extra roll shall automatically drop in place when bottom roll is depleted. Unit shall be equipped with two theft-resistant, heavy-duty, one-piece, molded ABS non-controlled delivery spindles.
      4) Manufacturer's service and parts manual shall be provided to the building owner / manager upon completion of the project.
      5) Toilet Tissue Dispenser shall not protrude into accessible space no more than 3" from the face of the wall.
      6) Acceptable manufacturers:

a) BOBRICK B-3888 -- 2-3/4" protrusion maximum.

b. Non-accessible Stalls: Controlled delivery, single roll, heavy-duty cast aluminum, satin finish, with high-impact plastic spindle with concealed locking device, theft-resistant, 6-1/4" wide, projects 4-7/8" from wall, surface mounted.

1) Acceptable manufacturers:

a) BOBRICK B-273.

b) BRADLEY 5071.

5. Toilet Tissue Dispenser :

a. Accessible Stalls: Recessed multi-roll toilet tissue dispenser shall be Type 304, 22 gage stainless steel with all-welded construction; exposed surfaces shall have satin finish.

1) The front of toilet tissue dispenser shall be drawn, one-piece, seamless construction. Door shall be secured to cabinet with two rivets and equipped with a tumbler lock keyed like other manufacturer's washroom accessories.

2) Flange shall be drawn, one-piece, seamless construction. Unit shall dispense two standard-core toilet tissue rolls up to 5-1/4" diameter.

3) Extra roll shall automatically drop in place when bottom roll is depleted. Unit shall be equipped with two theft-resistant, heavy-duty, one-piece, molded ABS non-controlled delivery spindles.

4) Manufacturer's service and parts manual shall be provided to the building owner / manager upon completion of the project.

5) Toilet Tissue Dispenser shall not protrude into accessible space no more than 3" from the face of the wall.

6) Acceptable manufacturers:

a) BOBRICK B-3888 -- 2-3/4" protrusion maximum.

b. Non-accessible stalls: Controlled delivery, double roll, heavy-duty cast aluminum, satin finish, with high-impact plastic spindles with concealed locking device, theft-resistant, 12-1/2" wide, projects 4-7/8" from wall, surface mounted.

1) Acceptable manufacturers:

a) BOBRICK B-274.

b) BRADLEY 5241.

6. Mop Holder (All janitor's rooms):

a. Stainless steel, 36" long - 4 holders.

1) Acceptable manufacturers:

a) BOBRICK B-223 x 36.

b) BRADLEY 9954.

7. Grab Bars:

a. 1-1/2" diameter, 18 gage seamless, stainless safety-grip finish, exposed mounting, vandal resistant screws, minimum of three attachment points matching attachment configuration shown on drawings, in configuration as required.

1) Acceptable manufacturers:

a) BOBRICK B-6806-99.

b) BRADLEY 812-2.

8. Recycle Collection Bin:

a. 44 gallon blue plastic container with molded side channels and handles with recycling symbol.

1) Acceptable Manufacturer:

a) Rubbermaid, Brute H-1860BLU

9. Mirrors (Type 1):

a. One piece channel frame, galvanized steel back, wall mounted for accessibility as detailed on the drawings, 1/4" tempered glass, size as shown.

1) Acceptable manufacturers:

a) BOBRICK B-165 Series.

b) BRADLEY 781.

END OF SECTION

SECTION 10 44 00 – FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to furnish and install Fire Protection Specialties, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 04 22 00 CONCRETE MASONRY UNITS
   4. 05 12 00 STEEL AND FABRICATIONS
   5. 06 10 00 ROUGH CARPENTRY
   6. 09 22 16 METAL FRAMING
   7. 09 24 00 CEMENT PLASTER
   8. 09 29 00 GYPSUM BOARD
   9. 09 72 00 WALL COVERINGS
   10. 09 91 00 PAINTING
   11. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

A. Standards:
   1. In accordance with the following standards:
      a. NAAMM National Association of Architectural Metal Manufacturers

1.3 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES.
   1. Product Data, indicating Project, location in Project for each Model Number for Fire Extinguishers, Fire Blankets, Cabinets, Doors and Trim

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications:
      a. Engage an experienced Installer who has successfully completed three [**3**] projects of similar scope and size to that indicated for this Project.
   2. Manufacturer/Supplier Qualifications:
      a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
   a. NFPA National Fire Protection Association (NFPA 10).

1.5 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written standard warranty:
      a. Warranty Period One (1) Year.
   2. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.
      a. Failures include, but are not limited to, the following:
         1) Failure of hydrostatic test according to NFPA 10.
         2) Faulty operation of valves or release levers.
            a) Warranty Period: Six (6) years from date of Substantial Completion.

C. Installer's Warranty:
   1. In accordance with the terms of the Specification Section - WARRANTIES:
      a. Warranty period **One (1) Year.**

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
   1. Specified product manufacturer, or approved equivalent:
      a. LARSEN'S MANUFACTURING CO.
         1) Special hardware when required "Larsen-Loc".
         2) FEC-1:
            a) Non-rated Model #AL 2409-R3.
            b) Rated Model #AL-FS-2409-R3.
            c) Fire Extinguisher Model #MP5-A.
            d) Fire Extinguisher (Nut Processing Room) Model #MP10.
         3) FEC-2:
            a) Non-rated Model #AL 2409-SM.
            b) Fire Extinguisher Model #MP5-A.
            c) Fire Extinguisher (Vegetable/Crop Processing Room) Model #MP10.
         4) WB-1, General:
            a) Bracket Model #821.
            b) Fire Extinguisher Model #MP5-A.
         5) WB-1 at Kitchens:

a) Bracket Model #1007.
b) Fire Extinguisher Model #WC-6L.

b. Acceptable alternative manufacturer:
1) JL INDUSTRIES

2. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MANUFACTURED UNITS

A. Cabinet and Extinguisher Types:
1. Semi-Recessed "Architectural Series" Type FEC-1.
a. Where wall depth is insufficient to accept complete box depth.
b. Non-rated: Model No. AL 2409-R3, for rough opening of 25"H x 10-1/2"W x 3"D. Box is to be fabricated from manufacturer's standard heavy gage steel, white baked enamel box. Provide at non-rated walls.
c. Fire-Rated: Model No. AL-FS-2409-R3, for rough opening of 26-1/3"H x 11-5/8"W x 3-3/4"D. Box is to be fabricated from manufacturer's standard double wall heavy gage steel, white baked enamel, fire rated box, with approved fire rated barrier material. Provide at one-hour or two-hour rated walls.
d. Provide 2-1/2 inch Rolled Edge Trim all around, fabricated from extruded aluminum with a clear satin anodized finish, with all corners mitered.
e. Typical Door (1/2" thick) to be "Vertical Duo" with tempered glass. Door to be fabricated from extruded aluminum with a clear satin anodized finish with "Black" Vertical Style Die Cut Lettering indicating "FIRE EXTINGUISHER" placed on the hinge side of the cabinet door.
f. Typical Door Hardware shall include a satin finish pull handle with a self-adjusting roller latch and a continuous piano hinge.
g. Provide Multi-Purpose Fire Extinguisher with a UL Rating of 3A-40B:C or 4A-80B:C in the Nut Processing Room.
2. Surface Mounted "Architectural Series" Type FEC-2.
a. Model No. AL 2409-SM, outside trim dimensions of 27-1/2"H x 13"W x 6"D. Box is to be fabricated from manufacturer's standard clear satin anodized aluminum.
1) Mount with bottom edge 27" above finish floor dimension.
b. Typical Door (1/2" thick) to be "Vertical Duo" with tempered glass. Door and trim to be fabricated from extruded aluminum with a clear satin anodized finish with "Black" Vertical Style Die Cut Lettering indicating "FIRE EXTINGUISHER" placed on the hinge side of the cabinet door.
c. Typical Door Hardware shall include a satin finish pull handle with a self-adjusting roller latch and a continuous piano hinge.
d. Provide Multi-Purpose Fire Extinguisher with a UL Rating of 3A-40B:C or 4A-80B:C in the Vegetable/Crop Processing room.

B. Bracket and Extinguisher Type:
1. Surface mounted bracket Type WB-1.
a. General:
1) Provide Multi-Purpose Fire Extinguisher with a UL Rating of 3A-40B:C.
2) Model No. 821 extinguisher bracket, constructed of heavy gage steel with a white baked enamel finish.
b. Kitchen Locations:
1) Provide Fire Extinguisher Model No. WC-6L (Wet Chemical) with a UL Rating of 2A:K.

2) Provide extinguisher bracket Model No. 1007, constructed of heavy gauge steel with a white baked enamel finish.

c. Provide backing in wall for attachment of bracket(s).

2.3 FABRICATION

A. Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.
2. Prepare doors and frames to receive locks.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
1. Fabricate door frames of one-piece construction, with edges flanged.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.5 STEEL FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.

B. Baked-Enamel Finish: Immediately after cleaning and pre-treating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual that affect the execution of work under this specification section.
a. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets will be installed.
b. Examine walls and partitions for suitable blocking where surface applied brackets will be installed.
c. Examine fire extinguishers for proper charging and tagging.

1) Remove and replace damaged, defective, or undercharged units.

2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:
1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

C. Surface preparation:
1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

3.3 INSTALLATION

A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
   a. Comply with all applicable ADA and CBC requirements in regards to accessible mounting heights.
4. Set plumb, level, and square.
5. Identification:
   a. Apply decals, vinyl lettering, or other identification devices at locations indicated.

B. Layout:
1. Lines shall be straight and true.

3.4 ADJUSTING

A. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
1. Replace cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.5 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
1. Clean any soiled surfaces immediately.
2. In accordance with manufacturer's written instructions and recommendations.

a. Remove temporary protective coverings and strippable films, if any, as security fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.
b. Adjust cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
c. On completion of cabinet installation, clean interior and exterior surfaces as recommended in writing by manufacturer.
d. Touch up marred finishes, or replace cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended in writing or furnished by cabinet manufacturer.

3.6 PROTECTION

A. Protection from traffic:
1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

END OF SECTION

SECTION 11 40 00– FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material labor, equipment and services necessary to completely install all Food Service Equipment materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. The work referred to in this section consists of furnishing all labor and material required to provide and deliver all food service equipment hereinafter specified into the building, uncrate, assemble, hang, set in place, level, and completely install, exclusive of final utility connections. Final utility connections to all equipment, shall be part of the work under additional appropriate sections of the work and not part of the food service work.
   1. The equipment and its component parts shall be new and unused. All items of standard manufactured equipment shall be current models at the time of delivery. Parts subject to wear, breakage, or distortion shall be accessible for adjustment, replacement and repair.
   2. Each refrigeration items specification is written to provide minimum specifications and scope of work. Refrigeration equipment shall be designed and installed to maintain the following general temperature unless otherwise specified.

a.	Walk-In Refrigerators	1.7°C / 35°F
b.	Walk-In Freezers	-23.2°C / -10°F
c.	Reach-In Refrigerators	1.7°C / 35°F
d.	Reach-In Freezers	-23.2°C / -10°F
e.	Undercounter Refrigerators	1.7°C / 35°F
f.	Undercounter Freezers	-23.2°C / -10°F
g.	Cold Pan	5°C / 41°F

   3. The materials or products specified herein by trade names, manufacturer’s name or catalog number shall be provided as specified. Substitutions will not be permitted unless approved by owner's representative in writing no later than 10 days prior to bidding. This stipulation applies to all equipment and materials. All substitutions or alternates will be expected to perform in all respects as well as the original specification. Should no request for substitution be received and approved as listed above, the project is to be provided as specified.
   4. The food service equipment contractor shall be responsible for all costs associated with the acceptable alternate or approved alternate items, if the item requires additional space or specific utilities that differ from specifications or drawings. The FSEC is responsible for all coordination, documentation and costs associated with any alternate item that was not submitted for approval and accepted by the consultant prior to bid. The FSEC shall be responsible for any costs associated with building changes, utility changes and drawings changes.

C. Coordinate Owner and Vendor-supplied equipment noted on the drawings or in the specifications as NIFSEC, "not in food service equipment contract." Show on roughing in Plans and sizes, utilities, and other requirements as furnished in the specifications, by owner or appropriate supplier in submittals as if the equipment is contractor furnished.

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D. Bidders shall carefully examine the specifications and the project site including location and condition of existing equipment to determine cost for each "Existing-Reset" and "Existing-Modify" item to cover removal, modification (including materials), cleaning, inspection for damage, repair and resetting.

E. Field measurements shall be made prior to fabrication or installation of any equipment item.

F. The cutting of holes in equipment for pipe, drains, electrical outlets, etc., required for this installation, shall be part of this work. Work shall conform to the highest standards of workman-ship and shall include welded sleeves, collars, ferrules and escutcheons.

G. Repair of all damage to the premises as a result of the equipment installation as well as the removal of all debris left by the work of this section.

H. Food service equipment and fixtures shall be cleaned and ready for operation at the time the facility is turned over to the Owner for final inspection by the Owner's Representative.

I. Food Service Equipment Contractor shall be responsible for coordinating with the Architect and Contractor in submitting all applicable documents.

J. All bidders shall submit with their costing a list of the subcontractors that are included in their bids and a complete "schedule of values" for all equipment and labor.

K. Related Sections: The following Sections contain requirements that relate to this Section:
1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 06 41 23 MODULAR CASEWORK
4. 07 60 00 SHEET METAL
5. 09 22 16 METAL FRAMING
6. 09 24 00 CEMENT PLASTER
7. 09 29 00 GYPSUM BOARD
8. 09 30 13 TILE
9. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
    a. Refer to Division 22 Sections for water, waste and gas services to the fixtures including shut-off valves, trim, traps, etc., and final connections to the fixtures, except as specified differently in the specifications, drawings, or herein.
    b. Refer to Division 23 Sections for supply and exhaust fans; exhaust ductwork; service roughing-ins; drain traps; atmospheric vents; valves, pipes, and fittings; fire extinguishing systems; and other materials required to complete food service equipment installation.
        1) All hood or ventilator duct work above the connection position on such exhaust hoods or exhaust ventilators, except as specified differently in the specifications, drawings, or herein. Final welded connections at the junction point of exhaust hoods or exhausts ventilators, shall be part of the food service work.
    c. Refer to Division 26 & 28 Sections for connections to fire alarm systems, wiring, disconnects, and other electrical materials required to complete food service equipment installation.
        1) All electric services including wiring to, and final connections to, the fixtures except, as specified differently in the specifications, drawings, or herein.

1.2 DEFINITIONS

A. Terminology Standard: Refer to NSF 2, "Food Equipment," NSF 4, Heated Cabinets, NSF 7, Refrigerated Equipment, or other applicable NSF standards for definitions of food service equipment and installation terms not otherwise defined in this Section or in other referenced standards.
   1. FSEC: Food Service Equipment Contractor
   2. Owner-Furnished Equipment: Where indicated, Owner will furnish equipment items.
   3. Vendor-Furnished Equipment: Where indicated the Owner's or operator's vendor will furnish equipment items.
   4. NIFSEC: Not Included in Food Service Equipment Contract.

1.3 REFERENCES

A. Standards:
   1. In accordance with the following standards:
      a. AGA American Gas Association
      b. AISI American Iron and Steel Institute
      c. ASHRAE American Society of Heating, Refrigerating and Air-conditioning Engineers.
      d. AWS American Welding Society
      e. NSF National Sanitation Foundation may have occurred after the preparation of this specification section.
      f. UL Underwriters Laboratories

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Provide all material. labor, equipment and services necessary to completely install all Food Service Equipment materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

1.5 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. General:
      a. Regardless of drawing formats provided it will remain the responsibility of equipment supplier to develop submittals in accordance with the Specific Conditions and assume all required responsibilities there to.
      b. The consultant is not to be liable for errors or omissions by the FSEC¢s use of electronic data provided by the Consultant or the development of date used in the submittal approval process.
      c. Checking product data, rough-in drawings, wall backing drawings, shop drawings, and refrigeration drawings by Designer is for design concept only, and does not relieve the Food Service Equipment Contractor of responsibility for compliance with Contract Documents, verification of utilities with equipment requirements for conformity and location, verification of all dimensions of equipment and building conditions or reasonable adjustments due to deviations.
      d. The Food Service Equipment Contractor shall review and provide an affidavit with each submittal that such review has been completed by an authorized agent of the contractor.
   2. Product Data.

a. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.

3. Shop Drawings.
   a. Submit shop drawings from manufacturer and fabricator detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.
4. Quality Assurance/Control Submittals:
   a. Manufacturer's Written Instructions:
      1) Submit three (3) copies of manufacturer's written instructions.
   b. Service Representative Certification:
      1) Submit three (3) copies of the Certification of the Service Representative for the Food Service Equipment within a 50 mile radius of the Project Site.
5. Closeout Submittals in accordance with Specification Sections in Division One:
   a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
   b. Operation Data in accordance with Specification Section - PROJECT CLOSEOUT.
   c. Project Documents in accordance with Specification Section - PROJECT DOCUMENTS.
   d. Warranty in accordance with Specification Section -WARRANTIES, and of this specification section.

1.6 QUALITY ASSURANCE

A. Qualifications:
1. Material Qualifications:
   a. Equipment shall be designed in accordance with NSF and AGA and Bear the NSF Seal of Approval and be AGA certified.
2. Installer Qualifications:
   a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
   b. Walk-In Cooler / Freezer Equipment Installer shall be within a 50 mile radius of the Project Site for prompt service during the Installer's Warranty Period..
3. Manufacturer/Supplier Qualifications:
   a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
   b. Manufacturers and models listed in the Schedule of Food Service Equipment are used to establish minimum standards for design, performance and construction intended.
      1) Fabricators or custom built equipment shall have qualified personnel, plant and equipment suitable to produce the specified items within the time requirement of the construction schedule.
   c. Walk-In Cooler / Freezer Equipment Manufacturer shall have and maintain a Certified Service Representative within a 50 mile radius of the Project Site for any warranty issues that may arise during the equipment warranty period.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
   a. CHD Local County Health Department in which the Project is located.

C. Meetings:
1. Pre- Installation: Scheduled by the Contractor prior to start of equipment installation.
   a. Coordinate the work with all other related work.
   b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
   a. Review for proper installation of work progress.
   b. Identify any installation problems and acceptable corrective measures.
   c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
   a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
   b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
1. Products shall be individually wrapped.
2. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:
1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
2. No equipment shall be delivered directly to the hob site prior to having an installation crew on the premises, except with the written permission of the Architect or the Project Superintendent.
3. Fabricated equipment shall be shipped in sections to facilitate entry into the building.
4. Damaged products will not be accepted.

C. Storage and protection:
1. Products shall be stored in a dry, protected area.
2. Products shall be stored in locked storage building.
3. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
4. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.8 PROJECT CONDITIONS

A. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Field Measurements:
   a. Take and be responsible for filed measurements as required. Report any significant differences between field dimensions and Drawings to Architect prior to performing Work.
3. All Work within space shall be complete.

1.9 WARRANTY

A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
   1. In accordance with manufacturer's written standard equipment warranty for each item:
      a. Warranty Period One (1) Year.
      b. Manufacturer's to provide standard equipment warranties on all equipment if it exceeds the State of California Standard One Year Construction Warranties.

C. Installer's Warranty:
   1. In accordance with the terms of the Specification Section - WARRANTIES:
      a. Warranty period One (1) Year.
      b. Installers shall maintain an area Service Representative for the duration of the Service Warranty Period.
         1) Installer of the Walk-In Cooler / Freezer Equipment shall provide an area Service Representative within 50 miles of the Project Site.

1.10 OWNER'S INSTRUCTIONS

A. Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train the Owner's maintenance personnel as specified below:
   1. Test and adjust controls and any safeties. Replace damaged or malfunctioning controls and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Materials for Fabricated Food Service Equipment:
   1. General Requirements:
      a. Manufactured Food Service Equipment to be incorporated as an integral part of Fabricated Food Service Equipment where indicated.
      b. Provide opening as required for all faucets and provide all faucets as specified.
      c. Provide all sink-drains complete with 6 inch tailpiece.
      d. All work straight and uniform, of proper strength and accurately fitted together.
      e. Level and smooth all plain work.

f. All joints to be welded, ground smooth, buffed to No. 4 finish and in accordance with AWS.
g. Fabricate to field dimensions. Significant discrepancies with Drawings shall be reported to Architect prior to installation.
h. Slope drainboards 1/8 inch per foot to sink.
i. Slope sink bottoms 1/2 inch to drain for positive drainage.
j. All exposed edges of metal shall be ground round and smooth.
k. Sinks, disposer cones and similar to items shall be shop welded integral with top.

2. Materials:
   a. Stainless Steel in accordance with AISI 18-8, Type 302 with No. 4 finish on all exposed surfaces.
3. Construction:
   a. Counter Tops and Sinks: 14 gage stainless steel unless otherwise noted.
   b. Shelves: 16 gage stainless steel unless otherwise noted.
      1) Under shelves shall be galvanized iron.
   c. Legs:
      1) 1-5/8 inch outside diameter, 16 gage galvanized iron tuning with galvanized iron leg sockets and concealed thread galvanized iron bullet feet.
      2) Drill bottom of feet to receive floor anchor.
   d. Supports and Stiffeners: 14 gage stainless steel metal channels.
   e. Spacer: 2 inch wide, 10gage stainless steel Z.
   f. Fasteners Non-corrosive and tamper proof.
   g. Stainless Steel Wall Flashing: Provide 20 gauge stainless steel wall flashing with #4 finish. Provide all necessary closure and trim strips for a complete installation. Fabricate and install per the drawings.
   h. Stainless Steel Corner Guards: Provide 14 gauge corner guards with #4 finish Fabricate and install per the Drawings.

2.3 MANUFACTURED UNITS

A. General:
1. All plumbing and electrical which is an integral part of manufactured Food Service Equipment shall be complete and operable.
2. All plumbing supply connections shall be complete with female fittings.
3. All drains shall be complete with 6 inch tail piece.
4. All mechanical vents shall be complete with required dampers and ductwork extending a minimum of 3 inches from unit.
5. All motors shall be complete with on-off switch and starter.
6. All electrical connections shall be complete to outlet or junctions box. Connection to junction box and plug to outlet specified in Division 26, Electrical.
7. All equipment shall have NSF seal of approval.
8. Furnish all accessories and components listed in manufacturer's literature as standard with food service equipment specified by model or catalog number.
9. Furnish additional accessories or modifications to equipment as specified in the Fabricated Food Service Equipment Schedule at the end of this section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
1. Coordinate work under this specification section with work specified under other specification sections to ensure proper and adequate interface of work specified under this specification section.

3.3 INSTALLATION

A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved shop drawings.
3. In accordance with Regulatory Requirements and NSF.
4. Set plumb, level and square.
5. Accurately set all equipment.
6. Integrate different items as required for proper interface of equipment.

B. Layout:
1. Lines shall be straight and true.

3.4 ADJUSTING

A. Adjusting:
1. Food Service Equipment representative shall be present at mechanical and electrical check to test all food service equipment.
2. Test and adjust controls and safeties.
3. Replace damaged or malfunctioning controls and equipment.

3.5 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
1. Clean any soiled surfaces at the end of each day, minimum.
2. Finish shall be clean and ready for the application of any additional finishes.
3. In accordance with manufacturer's written instructions and recommendations.

3.6 DEMONSTRATION

A. In accordance with Specification Section - PROJECT CLOSEOUT.
1. Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train Owner's maintenance personnel as specified below.
a. Schedule training with the Owner's maintenance personnel with at least seven (7) days advance notice.

b. Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance.)
c. Review data in "Operating and Maintenance Manuals." Refer to Specification Section – PROJECT CLOSEOUT.

3.7 MANUFACTURED FOOD SERVICE EQUIPMENT SCHEDULE

A. **REFER TO DRAWINGS FOR FOOD SERVICE EQUIPMENT SCHEDULE.**

B. Reach-In Doors

1. Description:
   a. Pre-fabricated door assembly as manufactured by CDS.
      1) Cooler: 1 Set of (4) ADVANTAGE Series Normal Temperature, 30" x 75" glass door, hinged per print (Field Reversible), Black finish, Black Handle, 2-pane unheated tempered glass, Standard Tube LED lights, unheated door and frame, and 27" Deep 6-tier Black shelving with GALVANIZED Posts and energy code compliant.
      2) Freezer: 1 Set of (4) ADVANTAGE Series Low Temperature, 30" x 75" glass door, hinged per print (Field Reversible), Black finish, Black Handle, 3-pane heated tempered glass, Standard Tube LED lights, and 27" Deep 6-tier Black shelving with GALVANIZED Posts and Low Temp Energy Code Compliant Controllers.

C. WALK-IN COOLER/FREEZER

1. Description:
   a. Pre-fabricated, sectional, walk-in Cooler/Freezer as shown on the Drawings manufactured by MASTER-BILT.
   b. Provide with interior partition forming two compartment as shown on Drawings.
   c. Walls and ceiling shall consist of pre-fabricated metal panels separated by foamed-in-place urethane insulation.
2. Standards:
   a. Construction shall comply with National Sanitation Foundation and Factory Mutual System standards.
3. Panels:
   a. Panels shall consists of interior and exterior panels separated by foamed-in-place urethane insulation a minimum of 4" thick.
   b. Panels 4" thick shall have a U factor of 0.0300 or less.
   c. Foam core of panels shall be certified by Underwriters' Laboratory to have a flame spread of 25 or lower and smoke generation of 450 or lower when tested in accordance with UL standard 723.
   d. Panel edges shall have foamed-in-place tongues and grooves with flexible vinyl edge gaskets and interlock by means of cam action locking devices.
4. Finish:
   a. Interior wall, Exterior wall, interior ceiling: embossed coated steel, 26 gauge.
   b. Ceiling topside: smooth galvanized steel, 26 gauge.
5. Doors:
   a. Two (2) hinged flush fitting 34" x 78" of same material and requirements as panel sections.
   b. Doors to have continuous magnetic vinyl gasket all around and anti-sweat perimeter heater.
   c. Hardware:
      1) Chrome-plated brass.
      2) Each door to have two (2) self-closing, self-rising, cab-lift hinges.
      3) Each door to have additional standard hinge.

4) Door latch to be designed to easily open door by breaking the magnetic force of the door gasket.
5) Latch to have cylinder-type lock with an inside safety release handle.
6) Provide manufacture's standard exterior padlock hasp and staples for doors of Freezers and Coolers.

d. Door Viewports:
1) Cooler: 14 x 24 unheated viewport.
2) Freezer: 14 x 24 heated viewport.

6. Lights:
a. Provide wall mounted and ceiling mounted vapor-proof LED lighting fixtures.
b. Wall fixtures and exterior switches and pilot lights outside each door shall have concealed conduit to junction box above ceiling panels.
c. Electrical contractor to wire ceiling fixtures to switch.

7. Accessories:
a. Provide exterior reading dial thermometer for each box.
b. Provide heated vent for Freezer.
c. Ceiling Supports:
1) Provide structural steel of sufficient strength to support ceiling panels and wall panels where necessary.

d. Trim:
1) Provide stainless steel trim as required where walk-in box meets building surfaces.

8. Refrigeration Systems:
a. Systems shall be completely designed, furnished and installed within the scope of this Section.
b. Systems shall be the standard products and compatible with the Walk-In Cooler/Freezer product specified.
c. Submittal shall show all load-producing criteria in order to maintain Cooler temperature of 35 degree F and Freezer temp of 0 degree F using 100 degree F. ambient temperature. Include a complete list of components and catalog cuts.

9. Components:
a. Provide all components required to operate the systems including, but not necessarily limited to, the following:
1) Provide all components required to operate the systems including, but not necessarily limited to, the following:
2) Sight glass in liquid line at each condensing unit.
3) Shut-off valves, expansion valves.
4) Type "L" copper refrigerant piping, fully insulated with weatherproofing above roof.
5) Full refrigerant charge.
6) Hangers, straps, and clamps, insulated as required.
7) Blower coils with all necessary controls, switches and accessories.
8) Full temperature control system, including conduit and wiring.
9) Condensate collection and piping to floor sink.
10) Refrigerant suction lines are to be insulated with 3/4" elastomeric closed cell pipe insulation.

10. COOLER & FREEZER, ROOMS 106 & 107
a. Size: 24' long total x 16' wide x 8' – 2 5/8" high.
b. Coordinate Reach-in Door Systems.
c. Provide Trackport Door Systems.

11. COOLER & FREEZER, ROOMS 134 & 135
a. Size: 16’ long total x 10' wide x 8' – 2 5/8" high.

END OF SECTION

SECTION 12 24 13 – SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:
1. Provide all material, labor, equipment and series necessary to completely install all roller shades and accessories.

B. Related Sections: The following Project Manuel Sections contain requirements that relate to this section:
1. DIVISION 00 SPECIFICATION SECTIONS
2. DIVISION 01 SPECIFICATION SECTIONS
3. 05 12 00 STEEL AND FABRICATIONS
4. 06 10 00 ROUGH CARPENTRY
5. 06 22 00 MILLWORK
6. 08 11 00 METAL DOORS AND FRAMES
7. 08 41 00 STOREFRONTS
8. 08 80 00 GLASS
9. 09 22 16 METAL FRAMING
10. 09 24 00 CEMENT PLASTER
11. 09 29 00 GYPSUM BOARD
12. 09 50 00 ACOUSTICAL CEILINGS
13. 09 72 00 WALL COVERINGS
14. 09 91 00 PAINTING
15. SPECIFICATIONS IN THE FACILITY SERVICES SUBGROUP

1.2 REFERENCES

A. Standards:
1. In accordance with the following standards:
a. ASTM American Society for Testing and Materials
b. NFPA National Fire Protection Association
c. WCMA Window Covering Manufacturers Association

1.3 SUBMITTALS

A. Submit in accordance with specification section – SUBMITTAL PROCEDURES:
1. Product Data:
a. Submit manufacturer's full color range (including standard and premium colors) for selection by the Architect.
b. Submit data sheets on each piece of material being installed.
2. Shop Drawings:
a. Submit shop drawings showing fabrication and installation of the work of this section including plans, elevations, sections, details of components, and attachments to other units of work.
1) Include shadeband fabric orientation to rollers and their seam and batten locations.

2) For motor operated shades include details of installation and diagrams for power, signal, and control wiring.

3. Samples:
   a. Provide two 6 inch square samples of proposed fabric.
   b. Provide aluminum finish color samples.
4. Quality Assurance/Control Submittals:
   a. Test Reports:
      1) Submit four (4) copies of Fire Test Response Characteristics.
      2) Submit four (4) copies of No Growth when exposed to Fungi.
   b. Manufacturer's Written Installation Instructions.
   c. Statement of Installer's Qualifications.
5. Closeout Submittals in accordance with the following:
   a. Maintenance Data in accordance with Specification Section – PROJECT CLOSEOUT.
   b. Operation Data in accordance with Specification Section – PROJECT CLOSEOUT.
   c. Record Documents in accordance with Specification Section – RECORD DOCUMENTS.
   d. Warranty in accordance with this specification and Specification Section – WARRANTIES.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Material Qualifications:
   a. Roller shade must pass NFPA 701 "Fire Test Response Characteristics for small and large scale vertical burn." Materials tested shall be identical to products proposed for use.
   b. Roller shade must posses anti-microbial characteristics and show "No Growth" per ASTM G21 "Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi."
   c. Electrical components shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Installer Qualifications:
   a. Engage an experienced Installer who has successfully been in continuous business of providing and installing Roller Shade Systems and Accessories for a minimum period of five (5) years.
   b. Completed five (5) projects of similar scope and size to that indicated for this project.
3. Manufacturer/Supplier Qualifications:
   a. A company experienced in successfully producing/supplying products similar to that indicated for this project, with sufficient capacity to produce and supply required materials without causing delay in the work.

B. In accordance with specification section – REGULATORY REQUIREMENTS.

C. Meetings:
1. Pre- Installation……Schedule prior to the start of work.
   a. Coordinate the work with other work being performed.
   b. Identify any potential problems, which may impede the planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress:……Scheduled by the Contractor during the performance of the work.

a. Review for proper installation of work.
b. Inspect and identify any problems and acceptable corrective measures.
c. Identify any measures to maintain or regain project schedule if necessary.

3. Completion:……Scheduled by the Contractor upon proper completion of the work.
   a. Inspect and identify any problems which may impede issuance of warranties.
   b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
1. Products shall be individually wrapped and in factory packages.
2. Products shall be handled in such a manner as to assure that they are free from dents, tears, and other damage.
3. Shadeband fabric shall be protected from snagging, soil, and other damage. In the event that fabric suffer damage, the fabricator shall clean, repair or replace at no additional expense.

B. Acceptance at Site:
1. Products must be in manufacturer's original unopened packaging with labels indicating manufacturer, product name, and location for installation using same designation indicated on drawings.
2. Damaged product will not be accepted.
3. Products shall not be delivered to the project site until the area is ready for installation.

C. Storage and protection
1. Products shall be stored in a dry protected area.
   a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.6 PROJECT CONDITIONS

A. Existing conditions:
1. Examine project site and building(s) and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Verify actual dimension of openings and construction contiguous with the roller shades by field measurements before fabrication.

1.7 WARRANTY

A. Contactor's General Warranty:
1. In accordance with specification section – WARRANTIES.

B. Manufacturer's Warranty:
1. In accordance with manufacturer’s written standard warranty.
   a. Hardware System and Shadebands 10 years.
   b. Motors and Electronic Controls 5 years.

C. Installer's Warranty:

1. In accordance with the terms of the specification section- WARRANTIES but the period of time shall be for: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified Manual Shade System product manufacturer:
   a. MECHOSHADE SYSTEMS INC., Long Island City, New York
   b. Acceptable alternative manufacturers:
      1) DRAPER INC., Spiceland, Indiana
      2) HUNTER DOUGLAS CONTRACT, Nysan Solar Control, Poway, CA
2. Specified Motorized Shade System product manufacturer:
   a. MECHOSHADE SYSTEMS INC., Long Island City, New York
   b. Acceptable alternative manufacturers:
      1) DRAPER INC., Spiceland, Indiana
      2) HUNTER DOUGLAS CONTRACT, Nysan Solar Control, Poway, CA
3. Specified Shadeband product manufacturer, or approved equivalent:
   a. MECHOSHADE SYSTEMS INC., Long Island City, New York
   b. Acceptable alternative manufacturers:
      1) DRAPER INC., Spiceland, Indiana
      2) HUNTER DOUGLAS CONTRACT, Nysan Solar Control, Poway, CA

B. Products from other manufacturers not listed must submit in accordance with specification section – SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Shadeband:

1. Light-Filtering Fabric:

a.	Manufacturer	MECHOSHADE SYSTEMS INC.
b.	Product Name	ThermoVeil Screens.
c.	Physical Characteristics:	
1)	Type	75% PVC Coating, 25% polyester yarn.
2)	Weave	Mesh.
3)	Thickness	0.043 inches.
4)	Weight	15.3 oz/sq yd.
5)	Openness Factor	3 percent.
6)	Maximum Roll Width	As wide as available to minimize seams.

   d. Performance Characteristics:
      1) Flame Retardant meets NFPA 701
      2) GreenGuard Indoor Air Quality Certified

2.3 MANUFACTURED UNITS

A. General:
1. Furnish a complete and operational shade system with accessories necessary for operation including brackets, operating mechanisms, rollers, couplers, shadeband, mounting hardware, and fasteners.
2. Provide shade hardware that allows for the removal of shade roller tubes from brackets and center supports without removing hardware from opening.
3. Provide shade hardware required to support 150 percent of the full weight of each shade.
   a. Hardware shall be corrosion resistant.
4. Provide positive mechanical engagement of drive mechanism to shade roller tube.
5. Roller Tube shall be extruded aluminum of a diameter and wall thickness required to support shade fabric without deflection.
   a. Shadeband attachment to Roller Tube: [**Removable spline fitting integral channel in tube.**]
      1) Shade hardware shall allow for the removal and re-mounting of shadeband without having to remove the shade tube from operating mechanism or support brackets.
   b. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
   c. Direction of Shadeband Roll shall be [**Regular, from back of roller**]
6. Roller-Coupling Assemblies shall be coordinated with operating mechanism and designed to join up to three in line rollers into a multiband shade that is operated by one roller drive-end assembly.

B. Manual Shade System:
1. Provide MECHOSHADE SYSTEM Mecho/5.
2. Provide Chain and Clutch operating mechanism with continuous-loop bead chain and clutch that stops shade movement when bead chain is released.
   a. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
   b. Bead chains shall be #10 stainless steel with upper and lower limit ball stops.
      1) Chain retainer type: [**Jamb Mounted Clip**]
      2) Loop length shall be [**full length of shade**]
   c. Provide manufacturer's standard Spring Lift Mechanism for shadebands that weigh more than 10 lbs.
   d. Refer to Opening Schedule for location.

C. Motorized Shade System:
1. Provide MECHOSHADE SYSTEM ElectroShade with WhisperShade IQ motors.
2. Provide electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors.
   a. Electric Motor shall be enclosed in roller.
      1) Electrical Characteristics: Single Phase, [**110**] V, 60 Hz.
   b. Control System:
      1) Enclosure box for electric controls shall be NEMA ICS 6, Type 1 for [**surface**] mounting.
      2) Group Control Station: Three position rocker-style, wall switch operated control station with open, close, and center off function for single-switch group control.
   c. Refer to Opening Schedule for Location.

2.4 ACCESSORIES

A. Front Fascia:
   1. Provide L-shaped aluminum extrusion to conceal roller, shadeband and operating mechanism and attaches to roller endcaps without exposed fasteners.

B. Endcap Covers:
   1. Provide aluminum extrusion to cover endcaps and match Front Fascia.

C. Exposed Headbox:
   1. Provide extruded aluminum rectangular enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.

D. Recessed Shade Packet:
   1. Provide extruded aluminum rectangular enclosure designed for recessed ceiling installation with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
      a. Provide pocket with lip at lower edge to support acoustical ceiling panel.

E. Closure Panel:
   1. Provide removable aluminum panel and snap-in wall clip for installation at bottom of site-built ceiling recess or pocket. Size as indicated.

2.5 FABRICATION

A. Shadebands:
   1. Fabricate manual shade system to comply with WCMA A100.1 for requirements relative to flexible chain-loop devices.
   2. Fabricate units in sizes to fill window and other openings as follows, measured at 74 degrees Fahrenheit.
      a. Inside Jamb installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch. Length equal to head-to-sill or –floor dimension of opening in which shade is installed less 1/4 inch , plus or minus 1/8 inch.
      b. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end –to-end installations at centerlines of mullion or other defined vertical separations between openings.
   3. Fabricate shadebands without battens or seams to extent possible except as follows:
      a. At vertical shades where width-to-length ratio of shadeband is equal to or greater that 1:4, provide battens and seams at uniform spacing’s along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
      b. Railroad material where roll width is less that the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.
      c. Battens, when required or indicated, shall be concealed in a integrally-colored fabric to match the inside and outside colors of the shadeband.
         1) Battens shall be roll-formed of stainless steel or tempered steel and concave to match the contour of the roller tube.
   4. Fabricate shadebands to hang flat without buckling or distortion.
   5. Fabricate bottom hem with hem weights.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
1. Before proceeding, verify plans match existing conditions.
2. Review documents of existing construction provided by Owner against existing conditions.
3. If conflicts are encountered, report it to the Architect. Then prepare recommendation(s) for correction and submit to Architect for review.
4. Coordinate work under this specification section with work specified under other sections.

B. Protection:
1. Protect all adjacent surfaces from potential damage from work under this specification section.

C. Surface Preparation:
1. Prepare surface in accordance with manufacturer's instructions and recommendations.

3.3 INSTALLATION

A. General:
1. In accordance with manufacturer's instruction and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with regulatory requirements.
4. Set plumb, level, and square and align with adjacent units as indicated.
5. Allow proper clearances for window operation hardware.
6. Locate shadeband to be no closer than 2 inches to interior face of glass.
7. Connect motor-operated shades to building electrical system.

3.4 ADJUSTING

A. Adjustment:
1. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

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3.5 CLEANING

A. Clean in accordance with specification section – PROJECT CLOSEOUT:
   1. Immediately clean any soiled surfaces to remain.
   2. After installation clean in accordance with manufacturer’s instructions and recommendations.

3.6 DEMONSTRATION

A. In accordance with specification section – PROJECT CLOSEOUT.
   1. Engage a factory authorized representative to train owner's maintenance personnel to adjust, operate, and maintain shade systems.
   2. Schedule training with seven days of advance notice.

END OF SECTION

SECTION 21 05 17 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.

2. Stack-sleeve fittings.
Sleeve-seal systems.
Sleeve-seal fittings.
Grout.
Silicone sealants.

ACTION SUBMITTALS

Product Data: For each type of product.

PRODUCTS

SLEEVES

Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, with plain ends and integral welded waterstop collar.

Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

STACK-SLEEVE FITTINGS

Description: Manufactured, galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

Underdeck Clamp: Clamping ring with setscrews.

SLEEVE-SEAL SYSTEMS

Description:

Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
Designed to form a hydrostatic seal of 20 psig (137 kPa) minimum.
Sealing Elements: High-temperature-silicone interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
Pressure Plates: Carbon steel.
Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 of length required to secure pressure plates to sealing elements.

SLEEVE-SEAL FITTINGS

Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

Plastic or rubber waterstop collar with center opening to match piping OD.

GROUT

Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

Packaging: Premixed and factory packaged.

SILICONE SEALANTS

Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, Use NT.

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Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

EXECUTION

SLEEVE INSTALLATION

Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

Sleeves are not required for core-drilled holes.

Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
Cut sleeves to length for mounting flush with both surfaces.

Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.

Install sleeves for pipes passing through interior partitions.

Cut sleeves to length for mounting flush with both surfaces.
Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

SLEEVES AND SLEEVE SEALS
FOR FIRE-SUPPRESSION PIPING

STACK-SLEEVE-FITTING INSTALLATION

Install stack-sleeve fittings in new slabs as slabs are constructed.

Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.

Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."

Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.

Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

Use silicone sealant to seal around the outside of stack-sleeve fittings.

Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- or smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

SLEEVE-SEAL-SYSTEM INSTALLATION

Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

SLEEVE-SEAL-FITTING INSTALLATION

Install sleeve-seal fittings in new walls and slabs as they are constructed.

Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

Secure nailing flanges to concrete forms.

Use grout or silicone sealant, to seal the space around outside of sleeve-seal fittings.

FIELD QUALITY CONTROL

Perform the following tests and inspections:

Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

Prepare test and inspection reports.

SLEEVE AND SLEEVE-SEAL SCHEDULE

Use sleeves and sleeve seals for the following piping-penetration applications:

Exterior Concrete Walls above Grade:

Piping Smaller Than NPS 6: Steel pipe sleeves.
Piping NPS 6 and Larger: Steel pipe sleeves.

Exterior Concrete Walls below Grade:

Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.

Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.

Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

Concrete Slabs-on-Grade:

Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.

Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.

Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

Concrete Slabs above Grade:

Piping Smaller Than NPS 6: Steel pipe sleeves.
Piping NPS 6 and Larger: Steel pipe sleeves.

Interior Partitions:

Piping Smaller Than NPS 6: Steel pipe sleeves.
Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 210517

SECTION 21 05 18 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. BrassCraft Manufacturing Co.
2. Dearborn Brass
3. Jones Stephens Corp.
4. Kennedy Manufacturing Company
5. Mid-America Fittings, Inc.
6. ProFlo

2.2 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.

C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

2.3 FLOOR PLATES

A. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
   b. Chrome-Plated Piping: One-piece steel or split-plate steel with polished, chrome-plated finish.
   c. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   f. Bare Piping in Unfinished Service Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   g. Bare Piping in Equipment Rooms: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

2. Escutcheons for Existing Piping to Remain:

   a. Chrome-Plated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

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e. Bare Piping in Unfinished Service Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
f. Bare Piping in Equipment Rooms: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor plate.
2. Existing Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 210518

SECTION 21 05 23 - GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Two-piece ball valves with indicators.
2. Bronze butterfly valves with indicators.
3. Iron butterfly valves with indicators.
4. Check valves.
5. Bronze OS&Y gate valves.
6. Iron OS&Y gate valves.
7. NRS gate valves.
8. Indicator posts.
9. Trim and drain valves.

1.3 DEFINITIONS

A. NRS: Nonrising stem.

B. OS&Y: Outside screw and yoke.

C. SBR: Styrene-butadiene rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. UL Listed: Valves shall be listed for Fire Protection in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Main Level: HAMV - Fire Main Equipment.

    a. Level 1: HCBZ - Indicator Posts, Gate Valve.
    b. Level 1: HLOT - Valves.

        1) Level 3: HLUG - Ball Valves, System Control.
        2) Level 3: HLXS - Butterfly Valves.
        3) Level 3: HMER - Check Valves.
        4) Level 3: HMRZ - Gate Valves.

2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.

    a. Level 1: VQGU - Valves, Trim and Drain.

B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:

    a. Indicator posts.
    b. Valves.

        1) Gate valves.
        2) Check valves.

            a) Single check valves.

        3) Miscellaneous valves.

C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.

D. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.

2. ASME B1.20.1 for threads for threaded-end valves.
3. ASME B31.9 for building services piping valves.

E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

F. NFPA Compliance: Comply with NFPA 24 for valves.

G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.

H. Valve Sizes: Same as upstream piping unless otherwise indicated.

I. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves NPS 2 (DN 50) and smaller.

2.2 TWO-PIECE BALL VALVES WITH INDICATORS

A. Manufacturers
   1) Victaulic Co. of America.
   2) Nibco Inc.

B. Description:

1. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body Design: Two piece.
4. Body Material: Forged brass or bronze.
5. Port Size: Full or standard.
6. Seats: PTFE.
7. Stem: Bronze or stainless steel.
8. Ball: Chrome-plated brass.
9. Actuator: Worm gear or traveling nut.
10. Supervisory Switch: Internal or external.
11. End Connections for Valves NPS 1 (DN 25) through NPS 2 (DN 50): Threaded ends.
12. End Connections for Valves NPS 2-1/2 (DN 65): Grooved ends.

2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers
   1) Milwaukee Valve Company
   2) Globe Fire Sprinkler Corp.
   3) Fivalco, Inc.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
2. Minimum: Pressure rating: 175 psig (1200 kPa).
3. Body Material: Bronze.
4. Seat Material: EPDM.
5. Stem Material: Bronze or stainless steel.
6. Disc: Bronze, Stainless steel, or with EPDM coating.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 (DN 25) through NPS 2 (DN 50): Threaded ends.
10. Ends Connections for Valves NPS 2-1/2 (DN 65): Grooved ends.

2.4 IRON BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers

1) Victaulic Co. of America.
2) Anvil International, Inc.
3) NIBCO Inc.
4) Globe Fire Sprinkler Corp.
5) Kennedy Valve Company
6) Tyco Fire Products LP
7) Fivalco Inc.
8) Zurn Industries, LLC

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Body Design: Grooved-end connections.

2.5 CHECK VALVES

A. Manufacturers

1) Victaulic Co. of America.
2) Viking Corporation
3) Anvil International, Inc.
4) NIBCO Inc.
5) Reliable Automatic Sprinkler Co., Inc
6) Globe Fire Sprinkler Corporation
7) Kennedy Valve Company

8) Tyco Fire Products LP
9) Fivalco Inc.
10) Zurn Industries, LLC

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.6 BRONZE OS&Y GATE VALVES

A. Manufacturers

1) Milwaukee Valve Company
2) NIBCO Inc.
3) United Brass Works, Inc.
4) Zurn Industries, LLC

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Threaded.

2.7 IRON OS&Y GATE VALVES

A. Manufacturers

1) Victaulic Co. of America.
2) NIBCO Inc.
3) Kennedy Valve Company
4) WATTS
5) Mueller Co
6) Hammond Valve
7) American Cast Iron Pipe Company
8) Clow Valve Company
9) Zurn Industries, LLC

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze.
5. Wedge Seat: Cast or ductile iron, or bronze.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

2.8 NRS GATE VALVES

A. Manufacturers

1) Victaulic Co. of America.
2) NIBCO Inc.
3) Kennedy Valve Company
4) Mueller Co
5) American Cast Iron Pipe Company
6) Clow Valve Company
7) Zurn Industries, LLC

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron.
5. Wedge Seat: Cast or ductile iron, or bronze.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

2.9 INDICATOR POSTS

A. Manufacturers

1) NIBCO Inc.
2) Kennedy Valve Company
3) Mueller Co
4) American Cast Iron Pipe Company
5) Clow Valve Company

B. Description:

1. Standard: UL 789 and FM Global standard for indicator posts.

2. Type: Underground, Pit or Wall.
3. Base Barrel Material: Cast or ductile iron.
4. Extension Barrel: Cast or ductile iron.
5. Cap: Cast or ductile iron.
6. Operation: Wrench.

2.10 TRIM AND DRAIN VALVES

A. Ball Valves:
1. Manufacturers
    1) Victaulic Co. of America.
    2) NIBCO Inc.
    3) Milwaukee Valve Company
    4) WATTS
    5) Potter Roemer LLC
    6) Tyco Fire Products LP
    7) Fire Protection Products, Inc
    8) Zurn Industries, LLC
    9) Fire-End & Croker Corporation
    10) Red White Valve Corp.

2. Description:

    a. Pressure Rating: 175 psig (1200 kPa.
    b. Body Design: Two piece.
    c. Body Material: Forged brass or bronze.
    d. Port size: Full or standard.
    e. Seats: PTFE.
    f. Stem: Bronze or stainless steel.
    g. Ball: Chrome-plated brass.
    h. Actuator: Handlever.
    i. End Connections for Valves NPS 1 (DN 25) through NPS 2-1/2 (DN 65): Threaded or Grooved ends

B. Angle Valves:
1. Manufacturers
    1) NIBCO Inc.
    2) United Brass Works, Inc.
    3) Fire Protection Products, Inc

2. Description:

    a. Pressure Rating: 175 psig (1200 kPa).
    b. Body Material: Brass or bronze.
    c. Ends: Threaded.
    d. Stem: Bronze.
    e. Disc: Bronze.
    f. Packing: Asbestos free.
    g. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:
1. Manufacturers
1) NIBCO Inc.
2) United Brass Works, Inc

2. Description:

a. Pressure Rating: 175 psig (1200 kPa).
b. Body Material: Bronze with integral seat and screw-in bonnet.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc Holder and Nut: Bronze.
f. Disc Seat: Nitrile.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

A. Comply with requirements in the following Sections for specific valve installation requirements and applications:

1. Section 211100 "Facility Fire-Suppression Water-Service Piping" for application of valves in fire-suppression water-service piping outside the building.
2. Section 211200 "Fire-Suppression Standpipes" for application of valves in fire-suppression standpipes.
3. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.
4. Section 211316 "Dry-Pipe Sprinkler Systems" for application of valves in dry-pipe, fire-suppression sprinkler systems.

5. Section 211339 "Foam-Water Systems" for application of valves in AFFF piping.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the pipe center.

F. Install valves in position to allow full stem movement.

G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.

I. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION 210523

SECTION 21 05 29 - HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal hanger-shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 210516 "Expansion Fittings and Loops for Fire-Suppression Piping" for pipe guides and anchors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

C. NFPA Compliance: Comply with NFPA 13.

D. UL Compliance: Comply with UL 203.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.

B. Copper Pipe and Tube Hangers:

1. Description: Copper-coated-steel, factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.

2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. Manufacturers:
   a. Unitstrut
   b. B-Line
   c. Flex-Strut Inc.
   d. G-Strut
   e. Haydon Corporation
   f. Thomas & Betts Corporation
   g. Wesanco, Inc
2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with inturned lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Non-MFMA Manufacturer Metal Framing Systems:
1. Manufacturers:
   a. Anvil International
   b. Carpenter & Paterson, Inc
   c. Empire Industries, Inc
   d. ERICO International Corporation
   e. PHD Manufacturing, Inc
2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with inturned lips.
5. Channel Width: Select for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.5 THERMAL HANGER-SHIELD INSERTS

A. Manufacturers:
   a. Carpenter & Paterson, Inc

b. Clement Support Services
c. ERICO International Corporation
d. National Pipe Hanger Corporation
e. Pipe Shields Inc.
f. Piping Technology & Products, Inc
g. Rilco Manufacturing Co., Inc
h. Value Engineered Products, Inc

B. Insulation-Insert Material: Water-repellent-treated, ASTM C 533, Type I calcium silicate with 100-psi (688-kPa) minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.6 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.7 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M).

B. Carbon Steel: ASTM A 1011/A 1011M.

C. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A 240/A 240M.

E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal strut systems.

D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.

c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use thermal hanger-shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.

3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Comply with NFPA requirements.

L. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. C-Clamps (MSS Type 23): For structural shapes.
3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

M. Saddles and Shields: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

N. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

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P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 210529

SECTION 21 05 48 - VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Pipe-riser resilient supports.
5. Resilient pipe guides.
6. Elastomeric hangers.
7. Snubbers.
8. Restraint channel bracings.
9. Seismic-restraint accessories.
10. Mechanical anchor bolts.
11. Adhesive anchor bolts.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. HCAI: Department of Health Care Access and Information (HCAI)

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.

b. Annotate to indicate application of each product submitted and compliance with requirements.

B. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, due to seismic forces required to select vibration isolators, and due to seismic restraints.
3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
4. Seismic-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for fire-suppression piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: NICET Water-based Systems Layout III.

C. Welding certificates.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPM number from HCAI, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Assigned Seismic Use Group or Building Category as Defined in the CBC: II.

    a. Component Importance Factor: 1.5.
    b. Component Response Modification Factor: 4.5.
    c. Component Amplification Factor: 2.5.

2. Design Spectral Response Acceleration at Short Periods (0.2 Second):
3. Design Spectral Response Acceleration at 1.0-Second Period:
4. Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

    a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

2.2 SEISMIC-RESTRAINT ACCESSORIES

Through bolts with proper blocking

A. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings.

B. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet (12 m)o.c., and longitudinal supports a maximum of 80 feet (24 m)o.c.
3. Brace a change of direction longer than 12 feet (3.7 m).

D. Install seismic-restraint devices using methods shown on plan and approved by DSA.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are

encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Set through bolts to manufacturer's recommended torque, using a torque wrench.
3. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in "Section 211313 "Wet-Pipe Sprinkler Systems,".

END OF SECTION 210548

SECTION 21 05 53 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufactures
   a. Brady Corporation
   b. Brimar Industries, Inc
   c. Carlton Industries, LP
   d. Champion America
   e. Craftmark Pipe Markers
   f. Emedco

g. Kolbi Pipe Marker Co.
h. LEM Products Inc.
i. Marking Services, Inc
j. Seton Identification Products

2. Material and Thickness: Brass, 0.032 inch (0.8 mm), stainless steel, 0.025 inch (0.64 mm), aluminum, 0.032 inch (0.8 mm), or anodized aluminum, 0.032 inch (0.8 mm) thick, with predrilled holes for attachment hardware.
3. Letter Color: Red
4. Background Color: White
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufactures
   a. Brady Corporation
   b. Brimar Industries, Inc
   c. Carlton Industries, LP
   d. Champion America
   e. Craftmark Pipe Markers
   f. Emedco
   g. Kolbi Pipe Marker Co.
   h. LEM Products Inc.
   i. Marking Services, Inc
   j. Seton Identification Products
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) or 1/8 inch (3.2 mm) thick, with predrilled holes for attachment hardware.
3. Letter Color: Red
4. Background Color: White
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
7. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

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D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Manufactures
1. Brady Corporation
2. Brimar Industries, Inc
3. Carlton Industries, LP
4. Champion America
5. Craftmark Pipe Markers
6. Emedco
7. LEM Products Inc.
8. Marking Services, Inc
9. National Marker Company
10. Seton Identification Products
11. Stranco, Inc.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) 1/8 inch (3.2 mm) thick, with predrilled holes for attachment hardware.

C. Letter Color: Red

D. Background Color: White

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

G. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. Manufactures
1. Actioncraft Products, Inc.

2. Brady Corporation
3. Brimar Industries, Inc
4. Carlton Industries, LP
5. Champion America
6. Craftmark Pipe Markers
7. Emedco
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.
10. Marking Services, Inc
11. Seton Identification Products

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

F. Pipe-Label Colors:

1. Background Color: Safety Red.
2. Letter Color: White.

2.4 STENCILS

A. Stencils for Piping:

1. Manufactures
   a. Brimar Industries, Inc
   b. Carlton Industries, LP
   c. Champion America
   d. Craftmark Pipe Markers
   e. Kolbi Pipe Marker Co.
   f. Marking Services, Inc

2. Lettering Size: Size letters according to ASME A13.1 for piping.
3. Stencil Material: Aluminum, Brass, Fiberboard, or Metal.
4. Stencil Paint: Safety Red, exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: White, exterior, acrylic enamel. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

A. Manufactures
   a. Actioncraft Products, Inc
   b. Brady Corporation
   c. Brimar Industries, Inc
   d. Carlton Industries, LP
   e. Champion America
   f. Craftmark Pipe Markers
   g. Emedco
   h. Kolbi Pipe Marker Co.
   i. LEM Products Inc.
   j. Marking Services, Inc
   k. Seton Identification Products

B. Description: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping-system abbreviation and 1/2-inch (13-mm) numbers.

   1. Tag Material: Brass, 0.032 inch (0.8 mm) or stainless steel, 0.025 inch (0.64 mm) thick, with predrilled holes for attachment hardware.
   2. Fasteners: Brass or Steel wire-link chain or S-hook.
   3. Valve-Tag Color: Safety Red.
   4. Letter Color: White.

C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

   1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

1. Manufactures
   a. Brady Corporation
   b. Brimar Industries, Inc
   c. Carlton Industries, LP
   d. Champion America
   e. Craftmark Pipe Markers
   f. Emedco
   g. Kolbi Pipe Marker Co.
   h. LEM Products Inc.
   i. Marking Services, Inc
   j. Seton Identification Products

B. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

   1. Size: Approximately 4 by 7 inches (100 by 178 mm).
   2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping: Painting of piping is specified in Section 099123 "Interior Painting."

B. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:

a. Fire-Suppression Standpipe: 1-1/2 inches (38 mm), round.
b. Wet-Pipe Sprinkler System: 1-1/2 inches (38 mm), round.
c. Dry-Pipe Sprinkler System: 1-1/2 inches (38 mm), round.
d. Foam-Water System: 1-1/2 inches (38 mm), round.
e. Clean-Agent Fire-Extinguishing System: 1-1/2 inches (38 mm), round.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 210553

SECTION 21 11 00 - FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes fire-suppression water-service piping and related components outside the building and the following:

1. Pipes, fittings, and specialties.
2. Fire-suppression specialty valves.
3. Concrete vaults.
4. Protective enclosures.
5. Alarm devices.

B. Utility-furnished products include water meters that are furnished to the site, ready for installation.

C. Related Requirements:
1. Section 211119 "Fire-Department Connections" for exposed-, flush-, and yard-type, fire-department connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with FM Global's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.

C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end.

D. Grooved-End, Ductile-Iron Pipe Appurtenances:

1. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
2. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

E. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

F. Push-on-Joint, Ductile-Iron Fittings: AWWA C153, ductile-iron compact pattern.

1. Gaskets: AWWA C111, rubber.

G. Flanges: ASME B16.1, Class 125, cast iron.

2.2 PVC PIPE AND FITTINGS

A. PVC Pipe: AWWA C900, Class 150, with bell end with gasket, and with spigot end.

B. PVC Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

2.3 JOINING MATERIALS

A. Gaskets for Ferrous Piping and Copper-Alloy Tubing: ASME B16.21, asbestos free.

B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series.

C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

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2.4 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners, and with ends of same sizes as piping to be joined.
2. Standard: AWWA C219.
3. Center-Sleeve Material: Manufacturer's standard
4. Gasket Material: Natural or synthetic rubber.
5. Pressure Rating: 150 psig (1035 kPa) minimum.
6. Metal Component Finish: Corrosion-resistant coating or material.

2.5 CORPORATION VALVES

A. Corporation Valves: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

B. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.6 CURB VALVES

A. Curb Valves: Comply with AWWA C800 for high-pressure, service-line valves. Valve has bronze body, ground-key plug or ball, wide tee head, and inlet and outlet matching service piping material.

B. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches (75 mm) in diameter.

1. Shutoff Rods: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

C. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

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2.7 BACKFLOW PREVENTERS

A. Double-Check, Detector-Assembly Backflow Preventers:

1. Febco by Watts
2. Standards: ASSE 1048 and UL's "Fire Protection Equipment Directory" listing
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig (35 kPa) maximum, through middle one-third of flow range.
5. Size: 4” NPS.
6. Design Flow Rate: 475 gpm.
7. Pressure Loss at Design Flow Rate: 5 psig.
8. Body Material: Ductile iron with Stainless Steel check components
9. End Connections: Flanged.
10. Configuration: Designed for straight through flow.
11. Accessories:

    a. Valves: UL 262 and FM Global's "Approval Guide" listing; OS&Y gate type with flanged ends on inlet and outlet.
    b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

2.8 ALARM DEVICES

A. General: UL 753 and FM Global's "Approval Guide" listing, of types and sizes to mate and match piping and equipment.

B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig (1725-kPa) working pressure; designed for horizontal or vertical installation; with two single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.

C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.

D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with excavating, trenching, and backfilling requirements in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Water-Main Connection: Arrange with water utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.

E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install encasement for piping according to ASTM A 674 or AWWA C105.

F. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

G. Bury piping with depth of cover over top at least 30 inches (750 mm), with top at least 12 inches (300 mm) below level of maximum frost penetration, and according to the following:

1. Under Driveways: With at least 36 inches (910 mm) of cover over top.
2. In Loose Gravelly Soil and Rock: With at least 12 inches (300 mm)

H. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

I. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.

1. Terminate fire-suppression water-service piping within the building at 1’-0 above the floor slab. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.

J. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

K. Comply with requirements for fire-suppression water-service piping inside the building in the following Sections:

1. Section 211313 "Wet-Pipe Sprinkler Systems

L. Comply with requirements in Section 221116 "Domestic Water Piping" for potable-water piping inside the building.

M. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

N. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.

B. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

C. Ream ends of tubes and remove burrs.

D. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.

E. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

F. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.

G. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.

H. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139.

I. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

J. Do not use flanges or unions for underground piping.

3.4 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.

5. Heat-fused joints.
6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.5 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL-Listed or FM Global-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL-Listed or FM Global-Approved Valves Other Than Gate Valves: Comply with NFPA 24.

E. Support valves and piping, not direct buried, on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.6 DETECTOR CHECK VALVE INSTALLATION

A. Install in vault or aboveground.

B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

C. Support detector check valves and piping on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.7 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 (DN 65) and larger backflow preventers and piping on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.8 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire-department connection to mains.

B. Install protective pipe bollards on two sides of each freestanding fire-department connection.

3.9 ALARM DEVICE INSTALLATION

A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.

B. Supervisory Switches: Supervise valves in open position.

1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.

C. Locking and Sealing: Secure unsupervised valves as follows:

1. Valves: Install chain and padlock on open OS&Y gate valve.
2. Post Indicators: Install padlock on wrench on indicator post.

D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.

E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

F. Connect alarm devices to building's fire-alarm system. Wiring and fire-alarm devices are specified in Section 284621.11 "Addressable Fire-Alarm Systems."

3.10 CONNECTIONS

A. Connect fire-suppression water-service piping to existing water main.

3.11 FIELD QUALITY CONTROL

A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.

B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.

1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to zero psig (zero kPa). Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

D. Prepare test and inspection reports.

3.12 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping.

B. Permanently attach equipment nameplate or marker indicating plastic fire-suppression water-service piping or fire-suppression water-service piping with electrically insulated fittings, on main electrical meter panel. Comply with requirements for identifying devices in Section 220553 "Identification for Plumbing Piping and Equipment."

3.13 CLEANING

A. Clean and disinfect fire-suppression water-service piping as follows:

1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow it to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow it to stand for three hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

3.14 PIPING SCHEDULE

A. Underground fire-suppression water-service piping NPS 4 (DN 100) shall be one of the following:

1. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern fittings; glands, gaskets, and bolts; and gasketed joints. (Connections to hydrants and FDC)
2. PVC, Class 150 pipe listed for fire-protection service; PVC fittings of same class as pipe; and gasketed joints. (All piping not supplying hydrants or FDC)

B. Aboveground fire-suppression water-service piping NPS 4 shall be the following:

1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.

3.15 VALVE SCHEDULE

A. Underground fire-suppression water-service shutoff valves NPS 4 (DN 80) and larger shall be the following:

1. 200-psig (1380-kPa), AWWA, iron, nonrising-stem, metal seated gate valves.

B. Indicator-post underground fire-suppression water-service valves NPS 4 (DN 80) and larger shall be 175-psig (1200-kPa), UL-listed or FM Global-approved, iron, nonrising-stem gate valves with indicator-post flange.

C. Standard-pressure, **aboveground** fire-suppression water-service shutoff valves NPS 4 (DN 80) and larger shall be the following:

1. 200-psig (1380-kPa), AWWA, iron, OS&Y, metal seated gate valves. (DCDA)
2. AWWA butterfly valves. (Riser)

D. Fire-suppression water-service check valves NPS 4 (DN 80) and larger shall be the following:

1. AWWA check valves.
2. UL-listed or FM Global-approved detector check valves.

END OF SECTION 211100

SECTION 21 11 19 – FIRE DEPARTMENT CONNECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exposed-type fire-department connections.
2. Flush-type fire-department connections.
3. Yard-type fire-department connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department connection.

PART 2 - PRODUCTS

2.1 EXPOSED-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufactures
1. American Fire Hose & Cabinet
2. Elkhart Brass Mfg. Co.
3. Fire Protection Products, Inc.
4. Fire-End & Croker Corporation
5. GMR International Equipment Corporation
6. Guardian Fire Equipment, Inc.
7. Venus Fire Protection Ltd.
8. Wilson & Cousins Inc.

B. Standard: UL 405.

C. Type: Exposed, projecting, for wall mounting.

D. Pressure Rating: 175 psig (1200 kPa) minimum.

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Round, brass, wall type.

I. Outlet: Back, with pipe threads.

J. Number of Inlets: Two

K. Escutcheon Plate Marking: Similar to "AUTO SPKR"

L. Finish: Polished chrome plated.

M. Outlet Size: NPS 6 (DN 150)

2.2 FLUSH-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufactures
1. American Fire Hose & Cabinet
2. Elkhart Brass Mfg. Co.
3. GMR International Equipment Corporation
4. Guardian Fire Equipment, Inc.
5. Potter Roemer LLC
6. Venus Fire Protection Ltd.

B. Standard: UL 405.

C. Type: Flush, for wall mounting.

D. Pressure Rating: 175 psig (1200 kPa) minimum.

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Rectangular, brass, wall type.

I. Outlet: With pipe threads.

J. Body Style: Horizontal

K. Number of Inlets: Two

L. Outlet Location: Back

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M. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE"

N. Finish: Polished chrome plated

O. Outlet Size: NPS 6 (DN 150).

2.3 YARD-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufactures
1. Elkhart Brass Mfg. Co.
2. Fire Protection Products, Inc.
3. Fire-End & Croker Corporation
4. GMR International Equipment Corporation
5. Guardian Fire Equipment, Inc.
6. Potter Roemer LLC
7. Wilson & Cousins Inc.

B. Standard: UL 405.

C. Type: Exposed, freestanding.

D. Pressure Rating: 300 psig (2070 kPa)

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Round, brass, floor type.

I. Outlet: Bottom, with pipe threads.

J. Number of Inlets: Two

K. Sleeve: Brass

L. Sleeve Height: 18 inches (460 mm).

M. Escutcheon Plate Marking: Similar to "AUTO SPKR"

N. Finish, Including Sleeve: Polished chrome plated.

O. Outlet Size: NPS 6 (DN 150).

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fire-department connections.

B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-type fire-department connections.

B. Install yard-type fire-department connections in concrete slab support. Comply with requirements for concrete in Section 033000 "Cast-in-Place Concrete."

C. Install two protective pipe bollards on sides of each fire-department connection. Comply with requirements for bollards in Section 055000 "Metal Fabrications."

D. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION 211119

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

B. Related Requirements:

1. Section 211119 "Fire Department Connections" for exposed-, flush-, and yard-type fire department connections.
2. Section 230523 "General-Duty Valves for Water-Based Fire-Suppression Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

1.3 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 300 psig.

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. Compressed air piping.
3. HVAC hydronic piping.
4. Items penetrating finished ceiling include the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.

B. Qualification Data: For qualified Installer and professional engineer.

C. Design Data:

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. Field Test Reports:

1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
2. Fire-hydrant flow test report.

F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.9 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Construction Manager no fewer than three days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13 2016 Edition with State of California Amendments.
2. 2022 California Fire Code

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. High-Pressure Piping System Component: Listed for 300-psig working pressure.

D. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Provide fire-hydrant flow test record showing the following conditions:

a. Date.
b. Time.
c. Performed by.
d. Location of Residual Fire Hydrant R.
e. Location of Flow Fire Hydrant F.
f. Static Pressure at Residual Fire Hydrant R.
g. Measured Flow at Flow Fire Hydrant F.
h. Residual Pressure at Residual Fire Hydrant R.

2. Sprinkler system design shall be approved by authorities having jurisdiction.

a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
b. Sprinkler Occupancy Hazard Classifications:

1) Building Service Areas: Ordinary Hazard, Group 1.
2) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
3) General Storage Areas: Ordinary Hazard, Group 1.
4) Libraries except Stack Areas: Light Hazard.
5) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
6) Office and Public Areas: Light Hazard
7) Classroom Areas: Light Hazard.
8) Chemistry Lab: Ordinary Hazard, Group 2

3. Minimum Density for Automatic-Sprinkler Piping Design:

a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
d. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. area.
e. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. area.
f. Special Occupancy Hazard: As determined by authorities having jurisdiction.

4. Maximum Protection Area per Sprinkler: According to UL listing.
5. Maximum Protection Area per Sprinkler:

a. Office Spaces: 225 sq. ft..
b. Storage Areas: 130 sq. ft..
c. Mechanical Equipment Rooms: 130 sq. ft..
d. Electrical Equipment Rooms: 130 sq. ft..
e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.2 STEEL PIPE AND FITTINGS

A. Standard-Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Galvanized- and Black-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Schedule 10, Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

D. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

E. Galvanized- and Uncoated-Steel Couplings: ASTM A 865/A 865M, threaded.

F. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

G. Malleable- or Ductile-Iron Unions: UL 860.

H. Cast-Iron Flanges: ASME 16.1, Class 125.

I. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.

    a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
    b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.

2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

J. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

K. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers:
    a. Victualic Company
    b. Anvil International
    c. Corcoran Piping Systems Co.
    d. National Fittings, Inc
    e. Shurjoint Piping Products USA Inc
    f. Smith-Copper International
    g. Tyco Fire Products LP
2. Pressure Rating: 175-psig minimum.
3. Galvanized or Uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.

4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

L. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

1. Manufacturers:
   a. Victualic Company

2.3 COVER SYSTEM FOR SPRINKLER PIPING

1. Manufacturers:
   a. DecoShield Systems, Inc.

B. Description: System of support brackets and covers made to protect sprinkler piping.

C. Brackets: Glass-reinforced nylon.

D. Covers: Extruded-PVC sections of length, shape, and size required for size and routing of CPVC piping.

2.4 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
2. High-Pressure Piping Specialty Valves: 300-psig.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm Valves:

1. Manufacturers:
   a. Victualic Company
   b. Viking Corporation
   c. Reliable Automatic Sprinkler Co., Inc
2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

7. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the California Electric Code, by a qualified testing agency, and marked for intended location and application.

G. Deluge Valves:

1. Manufacturers:
   a. Victualic Company
   b. Viking Corporation
   c. Reliable Automatic Sprinkler Co., Inc
2. Standard: UL 260.
3. Design: Hydraulically operated, differential-pressure type.
4. Include trim sets for alarm-test bypass, drain, electrical water-flow alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, and fill-line attachment with strainer.
5. Wet, Pilot-Line Trim Set: Include gage to read diaphragm-chamber pressure and manual control station for manual operation of deluge valve, and connection for actuation device.

H. Automatic (Ball Drip) Drain Valves:

1. Manufacturers:
   a. Reliable Automatic Sprinkler Co., Inc
   b. Tyco Fire Products LP
2. Standard: UL 1726.
3. Pressure Rating: 175-psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.5 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:
1. Standard: UL 213.
2. Pressure Rating: 175-psig minimum.
3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
4. Type: Mechanical-tee and -cross fittings.
5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
7. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers:
   a. Victualic Company
   b. Reliable Automatic Sprinkler Co., Inc
   c. Tyco Fire Products LP
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.

4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

1. Manufacturers:
   a. Potter Electric Signal Company, LLC
   b. Potter Roemer LLC
   c. Elkhart Brass Mfg. Co., Inc
2. Standard: UL 199.
3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers:
   a. Victualic Company
   b. Viking Corporation
   c. Tyco Fire Products LP
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Manufacturers:
   a. Aegis Technologies, Inc.
   b. CECA, LLC
   c. Corcoran Piping System Co.
   d. Merit Manufacturing
2. Standard: UL 1474.
3. Pressure Rating: 300 psig.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:

1. Manufacturers:
   a. Victualic Company
   b. FlexHead Industries, Inc.
   c. Fivalco Inc.

d. Gateway Tubing, Inc.
2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 300 psig.
5. Size: Same as connected piping, for sprinkler.

2.6 SPRINKLERS

1. Manufacturers:
   a. Victualic Company
   b. Viking Corporation
   c. Reliable Automatic Sprinkler Co., Inc

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

E. Pressure Rating for High-Pressure Automatic Sprinklers: 300 psig.

F. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

G. Sprinkler Finishes: Chrome plated, bronze, brass, or factory painted.

H. Special Coatings: Wax and corrosion-resistant paint.

I. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat or Plastic, white finish, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel or Plastic, white finish, one piece, flat.

J. Sprinkler Guards:

1. Manufacturers:
   a. Victualic Company
   b. Viking Corporation
   c. Reliable Automatic Sprinkler Co., Inc
2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.7 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Manufacturers:
   a. Victualic Company
   b. Viking Corporation
   c. Tyco Fire Products LP
2. Standard: UL 753.
3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 8-1/2-inches diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4.
8. Outlet: NPS 1 drain connection.

C. Electrically Operated Alarm Bell:

1. Manufacturers:
   a. Potter Electric Signal Company LLC
   b. Notifier
   c. Fire-Lite Alarms, Inc
2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 10-inch diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the California Electric Code, by a qualified testing agency, and marked for intended location and application.

D. Water-Flow Indicators:

1. Manufacturers:
   a. Viking Corporation
   b. System Sensor
   c. Potter Electric Signal Company, LLC
2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

E. Pressure Switches:

1. Manufacturers:

a. Viking Corporation
b. System Sensor
c. Potter Electric Signal Company, LLC

2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

F. Valve Supervisory Switches:

1. Manufacturers:
   a. System Sensor
   b. Potter Electric Signal Company, LLC
   c. Kennedy Valve Company
   d. Fire-Lite Alarms, Inc
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the California Electric Code, by a qualified testing agency, and marked for intended location and application.

2.8 MANUAL CONTROL STATIONS

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve.

B. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.9 PRESSURE GAGES

A. Manufacturers:
   a. AGF Manufacturing, Inc.
   b. AMETEK, Inc.
   c. Ashcroft Inc
   d. Brecco Corporation
   e. WIKA Instrument Corporation

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0 to 300 psig.

E. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 211100 "Facility Fire-Suppression Water-Service Piping" for exterior piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Section 211100 "Facility Fire-Suppression Water-Service Piping."

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.3 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements for backflow preventers in Section 221119 "Domestic Water Piping Specialties."

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.4 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 and California Building Code requirements for seismic-restraint device materials and installation.

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D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

N. Pressurize and check preaction sprinkler system piping and air-pressure maintenance devices and air compressors.

O. Fill sprinkler system piping with water.

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

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3.5 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

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N. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

O. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.6 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and NFPA 13 for supports.

3.7 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.8 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.9 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.11 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.12 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps.

3.13 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded or grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
3. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Standard-weight, galvanized-steel pipe with roll-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
5. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
6. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
7. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
3. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Standard-weight, galvanized-steel pipe with roll-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
5. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
6. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
7. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

E. High-pressure, wet-pipe sprinkler system, NPS 4 and smaller, shall be one of the following:

1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with roll-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

F. High-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be one of the following:

1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with roll-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3.14 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers .
2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers as indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Recessed Sprinklers: Finish as indicated on plans, with corresponding escutcheon.
3. Upright, Pendent, and Sidewall Sprinklers: Finish as indicated on plans in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 211313

SECTION 22 00 00 – GENERAL PLUMBING PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section covers and applies to all work included in Divisions 22.

B. Work in this Section includes providing labor, materials, equipment, services necessary, fabrication, installation and testing for fully operational and safe systems including all necessary materials, appurtenances and features whether specified or shown in the contract documents or not, in conformity with all applicable codes and authorities having jurisdiction for the following:

1. Plumbing work covered by all sections within Division 22 of the specifications, including, but not limited to:

a. Plumbing systems and equipment.

1.3 CODES AND REGULATIONS

A. All work and materials shall be in accordance with current rules and regulations of applicable codes. Nothing in these Drawings or Specifications is to be construed to permit work not conforming to these codes. Should the Drawings or Specifications call for material or methods of construction of a higher quality or standard than required by these codes, the Drawings and Specifications shall govern. Applicable codes and regulations include, but are not necessarily limited to, the following:

California Building Code	CCR Title 24, Part 2
California Electrical Code	CCR Title 24, Part 3
California Mechanical Code	CCR Title 24, Part 4
California Plumbing Code	CCR Title 24, Part 5
California Energy Code	CCR Title 24, Part 6
California Fire Code	CCR Title 24, Part 9

1.4 DEFINITIONS

A. Provide: The term "provide" as used in these specifications or on the drawings shall mean furnish and install.

B. Piping: The term "piping" as used in these specifications or on the drawings shall mean all pipe, fittings, valves, hangers, insulation, etc. as may be required for a complete and functional system.

C. Ductwork: The terms "duct" or "ductwork" as used in these specifications or on the drawings shall mean all ducts, fittings, joints, dampers, hangers, insulation, etc. as may be required for a complete and functional system.

D. Wiring: The term "wiring" as used in these specifications or on the drawings shall mean all wiring, conduit, boxes, connections, transformers, relays, switches etc. as may be required for a complete and functional system.

1.5 PERMITS AND FEES

A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required. All charges are to be included in the work.

1.6 COORDINATION OF WORK

A. Examination: Before starting work, thoroughly examine existing and newly completed underlying and adjoining work and conditions on which the installation of this work depends. Report to the Engineer in writing all conditions which might adversely affect this work.

B. Layout: Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. Some work may be shown offset for clarity. The actual locations of all materials, piping, ductwork, fixtures, equipment, supports, etc. shall be carefully planned prior to installation of any work in order to avoid all interference with each other, or with structural, electrical, architectural or other elements.

C. Verification: If discrepancies are discovered between drawing and specification requirements, the more stringent requirement shall apply. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment. No work shall be prefabricated or installed prior to this coordination. No costs will be allowed to the Contractor for any prefabrication or installation performed prior to this coordination. Verify the proper voltage and phase of all equipment with the electrical plans.

D. Location of Utilities Prior to Trenching or Earthwork: The Contractor shall notify the Owner a minimum of two business days prior to beginning trenching or earthwork. Prior to this notification, the Contractor shall have marked all proposed trenches with paint and shall have contacted a utility locating company and have had this company mark all found underground utilities with paint. The Contractor shall then coordinate and arrange for a site visit with the Owner to review the proposed trenching and/or earthwork areas. Trenching and/or earthwork shall not begin until the Owner agrees. Repair and/or compensation for repair of marked utilities is the responsibility of the Contractor. The Owner retains the right to either self-perform the repair or require the Contractor to

complete the repair, as directed by the Owner. If while performing the work, the Contractor discovers utilities that have not been marked, the Contractor shall immediately notify the Owner verbally and in writing.

1.7 GUARANTEE

A. Guarantee shall be in accordance with the General Conditions. The Contractor shall repair any defects due to faulty materials or workmanship and pay for any resulting damage to other work which appears within the guarantee period. These Specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the certificate of guarantee shall be furnished to the Owner through the Engineer.

1.8 QUIETNESS

A. Piping, ductwork and equipment shall be arranged and supported so that vibration is a minimum and is not transmitted to the structure.

1.9 DAMAGES BY LEAKS

A. The Contractor shall be responsible for damages caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

1.10 EXAMINATION OF SITE

A. The Contractor shall examine the site, compare it with Plans and Specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.11 COMPATIBILITY WITH EXISTING SYSTEMS

A. Any work which is done as an addition, expansion or remodel of an existing system shall be compatible with that system.

1.12 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new unless otherwise noted. Materials and equipment of a given type shall be by the same manufacturer. Materials and equipment shall be free of dents, scratches, marks, shipping tags and all defacing features at time of project

acceptance. Materials and equipment shall be covered or otherwise protected during construction as required to maintain the material and equipment in new factory condition until project acceptance.

1.13 SUBMITTALS

A. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material or equipment shall not be ordered or installed until written review is processed by the Engineer.

B. Building information modeling (BIM):
   1. BIM process shall be performed at an LOD-400 level as part of developing the shop drawing and includes but is not limited to creating model of 3D objects in Revit or AutoCAD based program, modeling objects accurately based on actual cut lengths and with access and clearance requirements incorporated, and coordinating with all MEP trades.
   2. Deliverables to engineer: Detail, 1/4 inch equals 1 foot scale drawings.

C. All shop drawings must comply with the following:

   1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory. FAX submittals are not acceptable.

   2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer and Contractor, table of contents, and indexed tabs dividing each group of materials or item of equipment. All items shall be identified by the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on drawings.

   3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be high-lighted, circled or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled or detailed.

D. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and features desired. Proposed substitutions shall comply with the Owner’s General Requirements. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items. At the Engineer's request, furnish locations where equipment similar to the substituted equipment is installed and operating along with the user's phone numbers

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and contact person. Satisfactory operation and service history will be considered in the acceptance or rejection of the proposed substitution.

E. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed. If a resubmittal is required, submit a complete copy of the Engineer's review letter requiring such with the resubmittal.

1.14 MANUFACTURER'S RECOMMENDATIONS

A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of the particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

1.15 SCHEDULING OF WORK

A. All work shall be scheduled subject to the review of the Engineer and the Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work, and shall cause no delay to other Contractors engaged upon this project or to the Owner. HVAC equipment and functions, whether existing or new, shall be maintained in operating condition whenever the facility is occupied, unless otherwise approved by the Owner.

1.16 DEMOLITION

A. Existing equipment, ducts, piping, etc. noted for removal shall be removed and delivered to the Owner at a location to be determined by the Owner. Those items determined by the Owner to be of no value shall become the property of the Contractor and shall be removed from the job site by the Contractor at the Contractor's expense. Existing piping, ducts, services, etc. requiring capping shall be capped below floors, behind walls, above ceilings or above roof unless otherwise noted. Where items are removed, patch the surfaces to

match the existing surfaces.

1.17 HAZARDOUS MATERIAL REMOVAL

A. All hazardous material removal will be by the Owner. Hazardous material is to be removed before the work is started. If the Contractor discovers hazardous material which has not been removed, the Contractor shall immediately cease work in that area and promptly notify the Owner.

1.18 OPENINGS, CUTTING AND PATCHING

A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. Except as noted below, the actual openings and the required cutting and patching shall be provided by other Divisions. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall be provided by other Divisions. Cutting or coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

1.19 EXCAVATION AND BACKFILL

A. General: Barrel of pipe shall have uniform support on sand bed. Sand shall be free from clay or organic material, suitable for the purpose intended and shall be of such size that 90 percent to 100 percent will pass a No. 4 sieve and not more than 5 percent will pass a No. 200 sieve. Unless otherwise noted, minimum earth cover above top of pipe or tubing outside building walls shall be 24", not including base and paving in paved areas.

B. Excavation: Width of trench at top of pipe shall be minimum of 16", plus the outside diameter of the pipe. Provide all shoring required by site conditions. Where over excavation occurs, provide compacted sand backfill to pipe bottom. Where groundwater is encountered, remove to keep excavation dry, using well points and pumps as required.

C. Backfill:

1. 6" Below, Around, and to 12" Above Pipe: Material shall be sand. Place carefully around and on top of pipe, taking care not to disturb piping, consolidate with vibrator.

2. One Foot Above Pipe to Grade: Material shall be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to review by Engineer.

D. Compaction: Compact to density of 95% within building and under walkways, driveways, traffic areas, paved areas, etc. and to 90% elsewhere. Demonstrate proper compaction by testing at top, bottom and one-half of the trench depth. Perform these tests at three locations per 100' of trench.

1.20 CONTINUITY OF SERVICES

A. Existing services and systems shall be maintained except for short intervals when connections are made. The Contractor shall be responsible for interruptions of services and shall repair damage done to any existing service caused by the work. If utilities not indicated on the drawings are uncovered during excavation, the Contractor shall notify the Engineer immediately.

1.21 PROTECTIVE COATING FOR UNDERGROUND PIPING

A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru-Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. John-Mansville. Protective coating shall be extended 6" above surrounding grade.

B. All cast iron pipe shall have field applied tubular polyethylene encasement (polywrap) conforming to ANSI/AWWA C105/A21.5. All joints and transitions to have 2 layers of polywrap with ends sealed with adhesive tape or plastic tie straps around the poly wrap at 2'-0" intervals. Vertical risers to be wrapped thru vapor barrier. Wet seal joint water tight.

1.22 ACCESS DOORS

A. Provide access doors as required where equipment, piping, valves, ductwork, etc. are not otherwise accessible. Access doors shall match the wall or ceiling finish and fire rating as indicated on the Architectural drawings. 16-gage steel frame and 14-gage steel door with paintable finish, except in ceramic tile, where door shall be 16-gage stainless steel with satin finish. Continuous hinge. Deliver doors to the General Contractor for installation. Milcor. Unless otherwise noted, the minimum sizes shall be as follows:

1 valve up to 1-1/2"	12" x 12"
1 valve up to 3"	16" x 16"

1.23 CONCRETE ANCHORS

A. Steel stud with expansion wedge requiring a drilled hole – powder driven anchors are not acceptable. Minimum spacing shall be 12 diameters center to center and 10 diameters center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the ICC Evaluation Service Report (ESR) values. Minimum concrete embedment shall be the nominal embedment listed in the ESR table. Hilti Kwik Bolt TZ.

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1.24 EQUIPMENT ANCHORING AND OTHER SUPPORTS

A. Mechanical systems (equipment, ductwork, piping, conduit, etc.) shall be anchored in accordance with the CBC. All systems mounted on concrete shall be secured with a concrete anchor at each mounting point. All air handlers shall be mounted on spring isolators. Secure base plate as indicated above. Attachment of equipment, ductwork, piping, conduit, etc. supported on curbs or platforms shall be made to the side of curbs and platforms, where possible. Where screws or lag bolts must be installed through the top of a sheet metal cap, the installation shall be as follows. Pre-drill pilot hole. Fill pilot hole with polyurethane sealant. Install screw or lag bolt with a flat washer and an EPDM washer adjacent to the sheet metal.

1.25 SUPPORTS AND SEISMIC RESTRAINTS

A. Any structural element required to hang or support piping, ducts or equipment provided under this Division and not shown on other drawings shall be provided under this Division.

B. Mechanical systems (equipment, ductwork, piping, etc.) shall be provided with supports and seismic restraints in accordance with the CBC. Submit anchorage calculations and details stamped and signed by a structural engineer registered in the State of California. Submit shop drawings showing location, type and detail of restraints. Submit manufacturer’s data for restraints. Restraint system shall be Mason West, Inc. (OSHPD OPM 0043-13).

1.26 PAINTING

A. Paint all black iron supports, hangers, anchors, etc. with two coats of rust resisting primer. Also paint all uninsulated black iron piping exposed to weather with two coats of rust resisting primer.

1.27 ROOF PENETRATIONS AND PATCHING

A. Whenever any part of the mechanical systems penetrates the roof or exterior wall, the openings shall be flashed and counter-flashed water tight with minimum 22 gauge galvanized sheet metal. Flashing shall extend not less than eight inches from the duct, pipe, or supporting member in all directions unless detailed otherwise. All roof penetrations and patching shall be in accordance with the recommendations of the National Roofing Contractor's Association and the Owner’s roofing standards.

1.28 SYSTEM IDENTIFICATION

A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by pre-printed markers or stenciled marking, and include arrows to show direction of flow. Pre-printed markers shall be the type that wrap

completely around the pipe, requiring no other means of fastening such as tape, adhesive, etc. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floors, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portions of lines. Marking of short branches and repetitive branches for equipment connections is not required.

B. Below Grade Piping: Bury a continuous, pre-printed, bright-colored, metallic ribbon marker capable of being located with a metal detector with each underground pipe. Locate directly over buried pipe, 6” to 8” below finished grade.

C. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-4). Provide 1/2" high lettering - white on black background. Nameplates shall be permanently secured to the exterior of the unit.

D. Valves: Provide brass valve tags with brass hooks or chains on all valves of each piping system, excluding check valves, valves within equipment, faucets, stops and shut-off valves at fixtures and other repetitive terminal units. Prepare and submit a tagged-valve schedule, listing each valve by tag number, location and piping service. Deliver to Owner through the Engineer.

1.29 CLEANING

A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work. This includes but is not limited to building surfaces, piping, equipment and ductwork, inside and out. Surfaces shall be free of dirt, grease, labels, tags, tape, rust, and all foreign material.

1.30 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Printed: Three copies of Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts list for all faucets, trim, valves, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-3). All Wiring Diagrams shall agree with reviewed Shop Drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Pumps, Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included.

B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instructions that apply to the control system. The Engineer's office shall be notified 48 hours prior to this meeting.

C. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and

maintenance instructions (printed and verbal) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.31 RECORD DRAWINGS

A. The Contractor shall obtain one set of prints for the project, upon which a record of all construction changes shall be made. As the work progresses, the Contractor shall maintain a record of all deviations in the work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. building, curbs, walks. In addition, the water, gas, sewer, under floor duct, etc. within the building shall be recorded by offset distances from building walls. An electronic copy of the original drawings will be made available to the Contractor. The Contractor shall transfer the changes, notations, etc. from the marked-up prints to the electronic copy. The record drawings (marked-up prints, electronic drawings disc and a hard copy) shall be submitted to the Engineer for review.

1.32 ACCEPTANCE TESTING

A. The Contractor shall perform, document and submit all acceptance testing as required by California Code of Regulations, Title 24, Part 6.

END OF SECTION

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SECTION 22 00 50 – PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Division.

1.2 GENERAL MECHANICAL PROVISIONS

A. The preceding General Mechanical Provisions shall form a part of this Division with the same force and effect as though repeated here.

1.3 SCOPE

A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:

1. Sanitary sewer system.
2. Domestic water system.
3. Fuel gas system.
4. Drain system (including condensate drain).
5. All equipment as shown or noted on the drawings or as specified.
6. Demolition as indicated on drawings. Where demolition is called for, remove all equipment, piping, braces, housekeeping pads, supports and related items no longer required.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Sanitary Sewer:

1. Soil, Waste and Vent Piping: Inside Building and Within Five Feet of Building Walls: Standard weight coated cast iron pipe and fittings, CISPI 301, or hub end with rubber gaskets, ASTM A74, ASTM C564. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute as manufactured by Tyler, AB&I or Charlotte. Heavy-duty shielded couplings, Type 304 stainless steel, with neoprene gasket, ASTM C1540. Husky HD 2000, Clamp-All 80. Mission HeavyWeight MG Couplings are also acceptable. Size 2" and smaller above grade may be standard weight galvanized steel, ASTM

A120/A53, with coated cast iron recessed drainage fittings, ANSI B16.12. 2" and smaller exposed to view shall be galvanized steel, ASTM A120/A53, with coated cast iron recessed drainage fittings, ANSI B16.12.

All cast iron pipe shall have field applied tubular polyethylene encasement (polywrap) conforming to ANSI/AWWA C105/A21.5. All joints and transitions to have 2 layers of polywrap with ends sealed with adhesive tape or plastic tie straps around the poly wrap at 2'-0" intervals. Vertical risers to be wrapped thru vapor barrier. Wet seal joint watertight.

2. Cleanouts: Comparable models of Josam, Wade or Zurn are acceptable. Floor Cleanouts: Smith 4028 with nickel bronze top in finished areas; Smith 4228 in utility areas. Wall Cleanouts: Smith 4532 with stainless steel cover and screw. Pipe Cleanouts: Iron body with threaded brass plug.

3. Cleanout Box: Precast reinforced concrete. Cast iron lid marked for service. Christy F22 in foot traffic areas; G5 in roadways.

B. Water and Gas:

1. Cold Water Piping:

a. Inside Building, Within Five Feet of Building Walls, and All Above Grade:

1) Hard temper seamless copper, ASTM B88. Wrought copper fittings, ANSI B16.22. Type L with brazed joints (1100F, min.). 1-1/2" and smaller above grade may be soldered, 95-5 tin-antimony solder. All nipples shall be red brass (85% copper). Above grade fittings may be copper (1/2" to 2") or bronze (2-1/2" to 4") press fittings, ASME B16.18 or ASME B16.22. EPDM O-rings. Installation shall be in accordance with the manufacturer's installation instructions. Nibco, ProPress.

b. Outside Building - Below Grade:

1) Schedule 40 galvanized steel pipe, ASTM A120/A53. 150 psi galvanized malleable iron screwed fittings, ANSI B16.3. Galvanized steel shall have protective coating.

-or-

2) Same as Inside Building. Press fittings are not acceptable below grade.

-or-

3) 3" and Smaller: Schedule 40 Polyvinyl chloride (PVC) with solvent weld fittings where approved by administrative authority.

2. Hot Water Piping:

a. Inside Building - Above Slab: Same as Cold Water Piping - Inside

Building.

b. Outside Building or Below slab: Pre-insulated. Type L copper core. 1" foamed polyurethane insulation. Polyvinyl chloride jacket. Sealed ends. Rubber ring internal slip joint. Fittings shall be wrought copper, with brazed joints (1100F, min.). Ricwil, Thermal Pipe Systems.

3. Gas Piping:

a. Inside Building and All Above Grade: 2" and Smaller: Schedule 40 galvanized steel pipe, ASTM A120/A53. 150 psi galvanized malleable iron screwed fittings, ANSI B16.3, ANSI B31.8. Flexible connections shall be convoluted yellow brass with dielectric couplings, AGA approved. 2-1/2" and larger: Schedule 40 black steel pipe, ASTM A120/A53. Standard weight carbon steel welding fittings, long radius ells, ANSI B16.9.

b. Inside Building - Below Grade to Five Feet Outside Building: Same as Inside Building and All Above Grade. Provide sleeves and vents acceptable to administrative authority.

c. Outside Building - Below Grade: Polyethylene pipe and fittings, ASTM D2513. PolyPipe GDY 20, PE 2406/2708. Otherwise, piping shall be coated schedule 40 steel.

4. Valves and Specialties:

a. Valves:

1) General: Manufacturer's model numbers are listed to complete description. Equivalent models of Crane, Grinnell, Milwaukee, Nibco, Stockham or Walworth are acceptable. All valves of a particular type or for a particular service shall be by the same manufacturer. Butterfly valves may be substituted for 2-1/2" and larger gate valves above grade; see specification below. Use full port ball valve for 2” and smaller water shutoff valves; see specification below.

2) Gate Valve: 2" and Smaller: All bronze. Rising stem. Union bonnet. Wedge disk. Malleable iron handwheel. 200 psi WOG. Stockham B-105. 2-1/2" and Larger: Iron body, bronze mounted. Non-rising stem. Wedge disk. 200 psi WOG. Flanged or AWWA hub end as applicable. Stockham G-612. Underground valves shall have square operating nut. Provide one operating "T" handle for underground valves.

3) Butterfly Valve: Iron threaded lug body. Aluminum bronze disk. O-ring seals. Resilient, removable seat. 416 stainless steel shaft. 6" and smaller valves shall have multi-position lever handle. 8" and

larger valves shall have gear operator. Provide 2" extension neck at insulated pipes. Demco Series NE, Grinnell, Stockham

4) Check Valve: 2" and Smaller: All bronze swing check, regrinding. 200 psi WOG. Stockham B-319.

5) Ball Valve: Full port. Bronze body, cap, stem, disk and ball. Screwed connection. Lever handle. TFE seat. O-ring seals. 300 psi WOG. Apollo, Grinnell, Jomar.

6) Plug Valve: Valves in gas piping systems must be UL listed for gas distribution. 4" and Smaller: Eccentric bronze or nickel plated semi-steel plug. Semi-steel body. Bronze bushings. Buna-N-rings. 175 psi WOG. DeZurik Series 400. 1-1/2" and smaller natural gas valves may be full port ball valves. Apollo, Jomar, Grinnell.

7) Valve Box: Precast reinforced concrete. Cast iron lid marked for service. Christy G5 in roadways (use B-9 for ball valves).

8) Earthquake Valve: Valves must be UL listed for gas distribution and comply with ASCE 25. Cast-aluminum body with stainless-steel internal parts; horizontal orientation; nitrile-rubber, reset-stem o-ring seal; open-or-closet valve position indicator; composition valve seat with calpper held by spring or magnet locking mechanism; level indicator. 2” and Smaller: threaded connections. 2-1/2” and Larger: flanged connections. Pacific Seismic Products.

c. Miscellaneous Specialties:

1) Temperature and Pressure Relief Valve: ASME rated fully automatic, reseating combination temperature and pressure relief valve sized in accordance with energy input. Sensing element immersed within upper 6" of tank. Watts.

2) Union: 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi. Grinnell. Size 2-1/2" and Larger: Grooved pipe, synthetic gasket, malleable iron housing. Victaulic Style 77, Type "E" gasket, Grinnell.

3) Dielectric Coupling: Insulating union or flange rated for 250 psig. EPCO.

4) Shock Absorber: Multiple bellows. Seamless copper chamber approved for concealed installations. Designed and applied in accordance with PDI WH201. Sioux Chief, Watts.

5) Flexible Connection: Corrugated bronze core covered with high tensile bronze tubular braid. 150 psi working pressure. 2" and

smaller shall have screwed connections. 2-1/2" and larger shall have flanged connections. Flexonics, Keflex.

C. Drain Piping (including Condensate): Copper Type L with brazed joints as specified above for inside building cold water piping. No press fittings for drain piping.

D. Miscellaneous Piping Items:

1. Pipe Support:

a. Pipe Hanger: Steel "J" hanger with side bolt for piping 4" and smaller; steel clevis hanger for piping 5" and larger. Load and jam nuts. Size and maximum load per manufacturer's recommendation. Felt liner for copper piping. Hanger and rod shall have galvanized finish. B-Line, Grinnell, Unistrut.

b. Isolating Shield: Galvanized steel shell and reinforcing ribs. 1/4" non-conducting hair felt pad. Pipe hanger in accordance with paragraph above. Increase hanger size per manufacturer's recommendation. B-Line, Semco, Superstrut.

c. Construction Channel: 12-gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Grinnell, Unistrut.

2. Flashing: Vent flashing shall be 4 lb/ft2 lead, 16" sq. flange, length sufficient to be turned down 2" into vent. Oatey. Flashing for other piping through roof shall be prefabricated galvanized steel roof jacks with 16" sq. flange. Provide clamp-on storm collar and seal water tight with mastic. For cold process built-up roof, material shall be 4 lb/ft^2 lead instead of galvanized steel.

2.2 PIPING INSULATION MATERIALS

A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.

B. Pre-Molded Fiberglass: Heavy density sectional pre-molded fiberglass with vapor barrier laminated all service jacket and pressure sealing vapor barrier lap. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft2-F at a mean temperature of 50F. Perm rating 0.02, ASTM E96. Puncture rating 50 Beach units, ASTM D781. Provide 3" (min.) wide tape of same material as lap for butt joints. For hot water piping, thickness shall be 1" for pipe sizes 3/4" and less; 1-1/2" thickness for pipe sizes 1" and larger. Certainteed, Knauf, Johns-Manville, Owens-Corning.

C. Fiberglass Blanket: Unfaced. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft2-F at a mean temperature of 50F. 1-1/2" thickness. Knauf, Johns-Manville, Owens-Corning.

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D. PVC Jacket (for pipe, fittings and valves): Pre-molded polyvinyl chloride (PVC) jackets, 0.020" thickness. Size to match application. Provide solvent weld adhesive and PVC vapor barrier pressure sealing tape by same manufacturer. Zeston.

E. Stretchable Glass Fabric: Reinforcing mesh. 10 X 20 continuous filament glass yarns per inch. Johns-Manville.

F. Vapor Barrier Coating: Childers CP-30, Foster 30-25.

G. Lagging Adhesive: Childers CP-50A, Foster 30-36.

H. Outdoor Mastic: Childers CP-21, Foster 65-05.

I. Insulating Tape: Ground virgin cork and synthetic elastomeric. Black, odorless, and non-toxic. K factor 0.43 Btu-in/hr-ft2-F or less. Non-shrinking. For outdoor use, provide protective finish by same manufacturer. Halstead.

J. Molded Closed Cell Vinyl (Piping Insulation Under Disabled Accessible Lavatories and Sinks): Fully molded closed cell vinyl, 3/16" thick. Internal ribs on drain insulation to provide air gap. Thermal conductivity shall not exceed 1.17 BTU-in/hr-ft^2-°F at an average temperature of 73°F. Weep hole in cleanout nut enclosure. Out of sight nylon fastening system. Hinged cap over valve to allow access for servicing. Truebro Lav-guard.

2.3 FIXTURES

A. General: Provide rough-in for and install all plumbing fixtures shown on drawings. Except in equipment rooms, all trim, valves and piping not concealed in wall structure, above ceiling or below floors, shall be brass with polished chrome plate finish, unless noted otherwise. All enameled fixtures shall be acid resisting. Standard color is white unless otherwise noted.

B. Schedule: Refer to Plumbing Fixture Schedule on the drawings for list of fixtures and trim. Manufacturer's model numbers are listed to complete description. Equivalent models of American Standard, Eljer, Elkay, Haws, Kohler or T&S Brass are acceptable. For drainage fixtures, equivalent models of Josam, Smith or Zurn are acceptable.

C. Stops and P-Traps: All fixtures shall be provided with stops and P-Traps as applicable. Wall mounted faucets, valves, etc. shall have integral stops or wall mounted stops.

1. Stops: All hot and cold water supplies shall be 1/2" I.P.S. inlet angle stops with stuffing box, loose key lock shield, and brass riser (3/8" for 2-1/2 gpm and less, otherwise 1/2"). McGuire, Speedway.

2. P-Traps: Semi-cast brass, ground joint. 17-gage. Clean-out plug. Unobstructed waterway. California Tubular, McGuire.

2.4 EQUIPMENT

A. General Requirements:

1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.

2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.

3. Ratings:

   a. Electrical: Electrical equipment shall be in accordance with NEMA standards and UL or ETL listed where applicable standards have been established.

   b. Gas: Gas burning equipment shall be furnished with 100% safety gas shut-off, intermittent pilot ignition, and be approved by AGA.

4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.

5. Electrical:

   a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.

   b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts and other devices shall be in ungrounded conductors.

   c. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring.

B. Water Heater: Electric. Glass lined tank with magnesium anode protection. 150 psi working pressure. Fully insulated. Automatic temperature control. High limit control. Provide

ASME rated temperature and pressure relief valve sized in accordance with energy input, dielectric couplings and drain cock. UL listed. A.O. Smith, American Appliance, State Industries.

C. Water Heater: Electric. Tankless point-of-use instant hot water heater. Cast aluminum housing, celcon waterways and nichrome coils. Maximum 150 psi rating. UL listed. Chronomite, Eemax.

D. Circulating Pump: In-line centrifugal. Aluminum housing. All parts exposed to fluid, stainless steel. Water lubricated ceramic shaft and bearings. Epoxy encapsulated windings. Grundfos, Bell and Gossett, Taco.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. General:

1. Piping Layout: Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by the Engineer. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Vertical lines shall be installed to allow for building settlement without damage to piping. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted. Provide secondary drain piping where required.

2. Joints:

a. Threaded: Pipe shall be cut square and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.

b. Welded or Brazed: Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100F. Welding or brazing shall be performed by a Certified Welder or Brazer as certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.

c. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.

d. Electrical Equipment: Piping shall not be run over electrical panels, motor control centers or switchboards.

3. Fittings and Valves:

a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.

b. Reducers: Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.

c. Unions: A union shall be installed on the leaving side of each valve, at all sides of automatic valves, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.

d. Valves: All valves shall be full line size. Provide shut-off valve for each building and each equipment connection. Provide shut-off valve at each point of connection to existing piping. At equipment connections, valves shall be full size of upstream piping, except that gas valves within 18" of the point of connection to the equipment may be the same size as the equipment connection.

e. Valve Accessibility: All valves shall be located so that they are easily accessible. Valves located above ceilings shall be installed within 24" of the ceiling. Refer to specification 200000 for access requirements.

4. Pipe Support:

a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the beam. Vertical piping shall be supported with riser clamp at 20' on center (maximum). Support pipe within 12" of all changes in direction. Support individual pipes with pipe hanger. Copper piping systems which protrude through a surface for connection to a fixture stop or other outlet shall be secured with a drop ell, Grinnell No. 9788; nipple through surface shall be threaded brass.

1) Pressure Pipe:

Pipe Size (Inches)	Maximum Spacing* Between Supports (ft.)		
	Copper	Sch. 40 steel	Plastic
1/2	6	6	4
3/4	6	8	4
1	6	8	4
1-1/4	6	10	4
1-1/2	6	10	4
2	10	10	4

2-1/2	10	10	4
3	10	10	4
4	10	10	4

*Based on straight lengths of pipe with couplings only. Provide additional supports for equipment, valves or other fittings. Plastic piping shall be supported per the manufacturer's recommendations. Seismic requirements may reduce maximum spacing.

2) Gravity Drain Pipe: Piping shall be supported at each length of pipe or fitting, but in no case at greater spacing than indicated above for pressure pipe.

b. Hot and Cold Water Piping: All hot and cold water piping shall have isolating shield; no portion of this piping shall touch the structure without an isolating shield except at anchor points for fixture rough-in.

c. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for review.

5. Miscellaneous:

a. Escutcheons: Provide chrome plated metal escutcheons where piping penetrates walls, ceilings, or floors in finished areas.

b. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" annular clearance between sleeve and pipe for piping 3" and smaller, otherwise 2" annular clearance. Piping through walls below grade shall be sealed with Link-Seal.

c. Pipes Passing through Fire Rated Surfaces: Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe or pipe insulation sealed with fire rated materials in accordance with the requirements of the fire authority having jurisdiction.

d. Dielectric Couplings: Dielectric couplings shall be installed wherever piping of dissimilar metals are joined, except that bronze valves may be installed in ferrous piping without dielectric couplings.

e. Thermometer or Pressure Gage Tap: Provide tee for instrument well. Minimum size of pipe surrounding well shall be 1-1/2".

f. Exposed Pipe at Fixtures: Piping extending from finished surfaces into a finished room shall be chrome plated brass, except under kitchen sinks in commercial kitchens.

B. Sanitary Sewer Piping:

1. General: Where inverts are not indicated, sanitary sewer piping shall be installed at

1/4" per foot pitch. Piping 4" and larger may be installed at 1/8" per foot pitch where structural or other limitations prevent installation at a greater pitch. Bell and spigot piping shall be installed with barrel on sand bed; excavate hole for bell.

2. Cleanouts: Install cleanouts at ends of lines, at changes of direction greater than 45 degrees, and at not greater than 100 foot intervals. Locate interior cleanouts in accessible locations and bring flush to finished surface.

3. Vents: Vents shall terminate not less than 6" above the roof nor less than 24" from any vertical surface nor within 10' of any outside air intake. Install horizontal vent lines at 1/4" per foot pitch. Offset vents 2' minimum from gutters, parapets, ridges and roof flashing.

C. Water Piping: Connections to branches and risers shall be made from top of main. Supply header in fixture battery shall be full size to last fixture, reducing in size only on individual connections to each fixture in battery. Minimum pipe size shall be 3/4", unless otherwise noted. Exposed fixture stops and flush valves shall be installed with brass nipples for copper piping and galvanized nipples for galvanized piping. Nipples are to extend from outside of wall to fitting at header or drop behind finish wall surfaces. Pipe nipples shall be same size as stop or flush valve. Provide shut off for each building and each connection to equipment. Shock absorbers shall be installed in a vertical position per manufacturer’s instructions and per PDI-WH 201 where flush valves, metering faucets or other fast acting valves are connected to the domestic piping system. Only equipment mounted on vibration isolators shall be connected with flexible connections. Underground hot water and cold water piping which run parallel to each other shall be installed a minimum of 3 feet apart.

D. Gas Piping: Installation shall comply with CPC and NFPA 54 (National Fuel Gas Code). Shall be pitched to drain to dirt legs at low points. No unions shall be installed except at connections to equipment. Provide shutoff and dirt leg at each equipment connection. Only equipment mounted on vibration isolators shall be connected with flexible connectors. Under floor piping shall be sleeved and vented. Underground Polyethylene pipe and butt fusion fittings shall be joined in accordance with manufacturer's recommendations. Metal to plastic transition fittings shall be installed at all transitions. Provide 14-gage insulated tracer wire secured to pipe at 10' intervals with nylon ties. Terminate tracer 6" above grade at both ends.

E. Drain Piping (Including Condensate): Install with constant pitch to receptacle, 1/4" per foot where possible, otherwise 1/8" per foot minimum. Provide TEE with clean-out plug at all changes of direction. Provide trap at each air handling unit to prevent air leakage. Only equipment mounted on vibration isolators shall be connected with flexible connection. Piping not concealed in wall structure, above ceilings or below floors shall be chrome plated brass.

F. PVC Piping: Shall be cut square and assembled prior to solvent weld. Apply primer per manufacturer's recommendations. Coat male joint fully with solvent, make joint before solvent dries and wipe exterior clean.

3.2 PIPING INSULATION INSTALLATION:

A. Domestic Hot Water:

1. General: All domestic hot water piping, fittings and accessories shall be insulated.

2. Pipe: Apply pre-molded fiberglass sections to pipe using integral pressure sealing lap adhesive in accordance with manufacturer's recommendations. Stagger longitudinal joints. Seal butt joints with factory supplied pressure sealing tape.

3. Fittings and Valves:

a. Wrap all fittings and valves with pre-cut fiberglass blanket to thickness matching adjoining insulation. Cover blanket with PVC jacket in accordance with manufacturer's recommendations. Solvent weld. Seal all joints with factory supplied pressure sealing vapor barrier tape with 1-1/2" (min.) overlap on both sides of joint. Insulate valves to stem. Do not insulate unions, flanges or valves unless water temperature exceeds 140ºF or the piping is exposed to weather.

b. For miscellaneous fittings and accessories for which PVC jackets are not available or where proximity of fittings precludes a neat-appearing installation, the Contractor may cover the fiberglass blanket with stretchable glass fabric, one coat of lagging adhesive and a final coat of vapor barrier coating. All exposed ends of insulation shall be adequately sealed.

4. Additional Finish for Exposed Piping and Equipment: All piping and equipment exposed to view but protected from the weather shall be given an additional finish of PVC jackets.

B. Cold Water Piping-Freeze Protection: All cold water piping exposed to weather shall be wrapped with insulating tape, 50% overlap. Cover valves to stem. Apply at least two coats of protective finish.

C. Piping Insulation Under Disabled Accessible Lavatories and Sinks: Hot and cold water piping, hot and cold water stop and drain piping under disabled accessible lavatories and sinks shall be insulated with 3/16" thick molded closed cell vinyl to prevent accidental injury due to contact or temperature extremes. Installation shall be in accordance with manufacturer's instructions. There shall be no sharp or abrasive surfaces under disabled accessible lavatories and sinks.

3.3 FIXTURE INSTALLATION

A. Fixture Height: Shall be as indicated on Architectural drawings.

B. Floor Drains or Floor Sinks: Shall be placed parallel to room surfaces, set level, flush with floor, and adjusted to proper height to drain. Cover openings during construction to keep all

foreign matter out of drain line.

C. Wall Hung Fixtures: Shall be provided with proper backing and hanger plates secured to wall. Lavatories shall be supported with concealed arm supports. Fixtures mounted on carriers shall bear against stop nuts, clear of wall surface. Caulk fixtures against walls with white G.E. "Sanitary 1700" silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).

D. Floor Mounted Fixtures: Shall be provided with proper support plates. Grout at the floor with waterproof ceramic tile grout.

E. Other Connections: Rough-in and connection for trim or fixtures supplied by others shall be included in this specification section.

3.4 EQUIPMENT INSTALLATION

A. General: It shall be the responsibility of the equipment installer to insure that no work done under other specification sections shall in any way block, or otherwise hinder the equipment. All equipment shall be securely anchored in place.

B. Connections to Equipment: Where size changes are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.

3.5 TESTS AND ADJUSTMENTS

A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Engineer. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new section shall be included in the new test.

B. Gravity Systems:

1. Sanitary Sewer: All ends of the sanitary sewer system shall be capped and lines filled with water to the top of the highest vent, 10' above grade minimum. This test shall be made before any fixtures are installed. Test shall be maintained until all joints have been inspected, but no less than 2 hours.

2. Drains (Including Condensate): Similar to Sanitary Sewer.

C. Pressure Systems:

1. General: There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be

isolated from system before test is made.

2. Domestic Hot and Cold Water Piping: Maintain 100 psig water pressure for 4 hours.

3. Gas Piping: Maintain 100 psig air pressure for 4 hours.

3.6 DISINFECTION

A. Disinfect all domestic water piping systems in accordance with AWWA Standard C651, "AWWA Standard for Disinfecting Water Mains", and in accordance with administrative authority. Disinfection process shall be performed in cooperation with health department having jurisdiction and witnessed by a representative of the Engineer. During procedure signs shall be posted at each water outlet stating, "Chlorination - Do Not Drink". After disinfection, water samples shall be collected for bacteriological analysis. Certificate of Bacteriological Purity shall be obtained and delivered to the Owner through the Engineer.

END OF SECTION

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SECTION 22 11 23 – DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. In-line, sealless centrifugal pumps.
2. Horizontally mounted, in-line, close-coupled centrifugal pumps.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL, NSF 61 for booster pump package.

PART 2 - PRODUCTS

2.1 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Flowtherm Systems
2. Grundfos
3. TACO Incorporated.

B. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.

C. Skid Construction:

D. Pumps:
1. Pumps shall be mounted vertical multistage with stainless steel fitted construction and mechanical seals as called out on the plans. Pumps casings shall include vent and drain ports at the top and the bottom of the casings.
2. Pumps shall be rated with a maximum working pressure of 360 psig for vertical multi-stage and 225F continuous operating temperature.

3. Pumps shall run without excessive noise or vibration.

E. Motor
1. Pumps motors shall be VFD-rated premium efficient motors and shall meet the requirements of NEMA MG1. Motor shall have an (ODP) or (TEFC) enclosure as called out in the equipment schedule.
2. Each pump and motor to have nameplate listing manufacturer's name, pump serial number, capacity in GPM and feet of head at design conditions, motor horsepower, voltage frequency, speed and full load current.

F. Valves
1. Check valves shall be lead free, cast iron body with NSF61 approved fusion epoxy coating, center guided with stainless steel spring, and lead-free bronze discs.
2. Provide isolation valves at inlet and outlet of each pump, NSF61 approved butterfly or ball valves with union or flanged connections.

G. Header and Piping
1. Pump manifold headers shall be 304 stainless steel schedule 10 welded pipe for cold water service and 316 stainless steel schedule 10 welded pipe for hot water service. Header pipe size shall be designed or a maximum of 10 fps velocity. All pipe welds shall be performed by
2. ASME Section IX certified welders and shall be welded to ASME/ANSI B31-9 specifications. System suction and discharge connections shall be (flanged) or (grooved).

H. Controls
1. Pressure transducers shall be supplied on the suction and discharge manifold headers and factory wired to the control panel. For atmospheric break tank applications, the suction pressure transducer is mounted on the break tank to indicate tank level on the touchscreen display.
2. The control system shall be configured for "pressure staging" in a lead/lag sequence. (Flow staging is available with field-mounted flow meter)
3. Each pump shall be fitted with a thermally activated purge valve to allow water to be purged to a remote drain in the event of a system overheating.
4. The booster pump package shall include a factory wired AqualogicTM3.0 control panel, UL 508 listed in a NEMA 1 (NEMA 3R) enclosure with single point power connection and all necessary components to allow for automatic operation of the variable speed pumps. The panel shall include the following components:
    a. Main power disconnect, non-fused
    b. Control circuit transformer with fused secondary.
    c. Variable Frequency Drive for each pump
    d. Through the door circuit breaker disconnect for each pump.
    e. H-O-A selector switch for each pump
    f. Door Mounted Pump Status Lights shall include as a minimum:
        1) Pump Run
        2) Pump Out Of Service
    g. General Alarm
5. Digital programmable logic controller
6. HMI - Door mounted 6" color graphic touch screen display.
7. Audible General Fault Alarm – includes a push to silence button and a set of dry contacts wired to a terminal strip for remote monitoring. A general fault alarm shall occur upon pump fault, VFD fault, PLC fault, transducer failure, high system pressure, low suction

pressure, overload and network failure. The PLC shall maintain a data log including a date and time stamp of the past 20 system and VFD faults. These faults shall be displayed in English text on the HMI.

8. The micro-processor based supervisory controller (HMI) shall be a panel door mounted unit with color graphic touch screen display. The controller shall include PID control functions and control the VFD's through a network interface. In addition to sending the run command and speed reference signal to the VFD's through the network interface, the HMI shall display line voltage, output frequency, output current and fault conditions for each VFD. The HMI shall provide an easy to use operator interface to all system parameters and display those parameters in plain English and engineering unites. Monitoring functions shall be available to all users, but access to parameters shall be restricted by two levels of password protection.
9. Standard Variable Frequency Drive (VFD) features shall include over current, earth fault, electronic motor overload protection, over temperature, over voltage, under voltage, phase failure, PID close-loop controller, and automatic energy saving mode, motor synchronization, and user macro storage, auto restart after power failure, electronic motor potentiometer, 16 mixed frequencies and min/max frequency limitation.
10. Control logic shall include an energy saving proof of no demand shutdown, NDS, which tests the system demand and then shuts off the lead pump if no demand is proven. The lag pumps shall shut off when it operates at its minimum speed for an adjustable elapsed time.
11. The control logic shall also include the energy saving feature of dynamic set point adjustment, DSA, which automatically lowers or increases the system discharge operating pressure set point as the system demand changes. Alternative designs that do not utilize a built in software algorithm to compensate for the variable friction losses shall not be allowed to have their pressure transducer mounted on the discharge header; instead their transducer shall be provided loose and installed at the furthest remote location of the system to account for the variable friction losses within the piping system. The controls shall automatically stage the pumps and adjust the pump speed based on discharge pressure control. The lead and lag pumps shall be rotated after each system shutdown. The controls shall start a lag pump on lead pump failure. A high temperature safety shut down system shall be provided which uses a temperature sensor which measures the discharge water temperature and is directly connected to the PLC. If a high temperature occurs the system shall shut down and go into alarm. The pump water temperature monitoring must be used as a safety feature and cannot be used as an operating control. The controls shall include pump minimum run time and pump maximum run time adjustable set points.
12. The PLC shall be capable of connection to a building management system (BMS) using Modbus, BACnet or Lonworks.

I. The entire system shall be pre-assembled on a heavy structural steel frame. The frame shall be welded in accordance with AWS D1.1 specifications. The steel frame shall have a zinc oxide primer and a machine enamel finish coat.

J. Hydro-pneumatic bladder tank shall be ASME rated with a ring base and replaceable bladder. The tank shall be provided a union isolation ball valve, pressure gauge and drain valve.

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PART 3 - EXECUTION

3.1 PUMP INSTALLATION

A. Install pipe and fittings in accordance with reference standards, manufacturer's recommendations and recognized industry practices.

B. Field piping includes connections to suction and discharge headers, drain piping and piping to hydro-pneumatic pressure tank, when not skid mounted, with union ball valve, pressure gauge and drain.

C. Field electrical connections include main power to the control panel and control wiring to remote pressure transducer if required.

D. Flush and clean piping prior to testing.

E. The manufacturer shall pressure test the system prior to shipment. Test piping with water to a pressure of (125 psi) for 1 hour. No decrease in pressure allowed. Inspect joints in system under test.

F. Defective work or material shall be replaced or repaired as necessary and inspection and test repeated. Repairs shall be made with new materials. Test reports shall be included in the owner's manual.

G. The manufacturer shall test the control panel including operating logic, safeties and wiring prior to shipment.

H. Pressure test and control panel tests reports shall be signed by the manufacturer and included with the equipment O&M's.

I. The manufacturer's representative shall provide a system check and start-up service for the system. The system shall be warranted (including parts and labor) for a period of 12 months from date of start-up.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

1. Install flexible connectors adjacent to pumps in suction and discharge.

2. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping.

3. Install pressure gage at suction of each pump and pressure gage at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps.

D. Comply with Division 26 Sections for electrical connections, and wiring methods.

3.3 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123

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SECTION 221513 - GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes piping and related specialties for general-service compressed-air systems operating at 150 psig or less.

B. See Division 22 Section "General-Service Packaged Air Compressors and Receivers" for general-service air compressors and accessories.

1.2 PERFORMANCE REQUIREMENTS

1.3 SUBMITTALS

A. Product Data: For the following:

1. Pressure regulators. Include rated capacities and operating characteristics.
2. Automatic drain valves.
3. Filters. Include rated capacities and operating characteristics.
4. Lubricators. Include rated capacities and operating characteristics.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L seamless, drawn-temper, water tube.

1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
3. Copper Unions: ASME B16.22 or MSS SP-123.

B. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.

1. ASME B16.21, nonmetallic, flat, full-face, asbestos free, 1/8-inch maximum thickness.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

2.3 VALVES

A. Metal Ball, Butterfly, Check, Gate, and Globe Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping."

2.4 DIELECTRIC FITTINGS

A. General Requirements for Dielectric Fittings: Combination fitting of copper alloy and ferrous materials with insulating material; suitable for system fluid, pressure, and temperature. Include threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Dielectric Unions: Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

2.5 FLEXIBLE PIPE CONNECTORS

A. Bronze-Hose Flexible Pipe Connectors:

1. Working-Pressure Rating: 200 psig minimum.
2. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.7 ESCUTCHEONS

A. General Requirements: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.

B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.

2.8 SPECIALTIES

A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.

1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.

B. Air-Main Pressure Regulators: Bronze body, pilot-operated direct acting, spring-loaded manual pressure-setting adjustment, and rated for 250-psig inlet pressure, unless otherwise indicated.

C. Air-Line Pressure Regulators: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig minimum inlet pressure, unless otherwise indicated.

D. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket if wall mounting is required.

E. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Include mounting bracket if wall mounting is required.

F. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is required.

2.9 QUICK COUPLINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aeroquip Corporation; Eaton Corp.
2. Schrader-Bridgeport
3. Snap-Tite, Inc.; Quick Disconnect & Valve Division.
4. TOMCO Products Inc.

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C. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.

D. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.

1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
2. Plug End: Flow-sensor-bleeder type with barbed outlet for attaching hose.

E. Valveless Quick Couplings: Straight-through brass body with stainless-steel or nickel-plated-steel operating parts.

1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
2. Plug End: With barbed outlet for attaching hose.

2.10 HOSE ASSEMBLIES

A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig minimum working pressure, unless otherwise indicated.

1. Hose: Reinforced double-wire-braid, CR-covered hose for compressed-air service.
2. Hose Clamps: Stainless-steel clamps or bands.
3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
4. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Compressed-Air Piping between Air Compressors and Receivers: Use the following piping materials for each size range:
1. NPS 2 and Smaller: Type K or L, copper tube; wrought-copper fittings; and brazed joints.

B. Low-Pressure Compressed-Air Distribution Piping: Use the following piping materials for each size range:
1. NPS 2 and Smaller: Type K or L, copper tube; wrought-copper fittings; and brazed joints.

C. Drain Piping: Use the following piping materials:

1. [NPS 2 and Smaller: Type M copper tube; wrought-copper fittings; and brazed or soldered joints.

3.2 VALVE APPLICATIONS

A. Comply with requirements in "Valve Applications" Article in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Equipment Isolation Valves: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.

E. Install piping adjacent to equipment and machines to allow service and maintenance.

F. Install air and drain piping with 1 percent slope downward in direction of flow.

G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.

H. Equipment and Specialty Flanged Connections:

1. Use steel companion flange with gasket for connection to steel pipe.
2. Use cast-copper-alloy companion flange with gasket and brazed joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.

I. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

J. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping."

K. Install piping to permit valve servicing.

L. Install piping free of sags and bends.

M. Install fittings for changes in direction and branch connections.

N. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

O. Install unions, adjacent to each valve and at final connection to each piece of equipment and machine.

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Apply appropriate tape or thread compound to external pipe threads.

D. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Join according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.

G. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.5 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.

C. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.

D. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric unions in piping at connections of dissimilar metal piping and tubing.

3.7 FLEXIBLE PIPE CONNECTOR INSTALLATION

A. Install flexible pipe connectors in discharge piping of each air compressor.

B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.

3.8 SPECIALTY INSTALLATION

A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.

B. Install air-main pressure regulators in compressed-air piping at or near air compressors.

C. Install air-line pressure regulators in branch piping to equipment.

D. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.

E. Install coalescing filters in compressed-air piping at or near air compressors and upstream from mechanical filters.

F. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters.

G. Install quick couplings at piping terminals for hose connections.

H. Install hose assemblies at hose connections.

3.9 SLEEVE INSTALLATION

A. Install sleeves for pipes passing through concrete and masonry walls, gypsum board partitions, and concrete floor and roof slabs using galvanized-steel pipe.

B. Install sleeves in new walls and slabs as new walls and slabs are constructed.

C. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use Steel Pipe Sleeves.

D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.10 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
3. Bare Piping at Ceiling Penetrations in Finished Hygienic Process Spaces: One piece, stainless steel with polished finish.
4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.

3.11 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

3.12 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.13 FIELD QUALITY CONTROL

A. Perform field tests and inspections.

B. Tests and Inspections:

1. Piping Leak Tests: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
2. Repair leaks and retest until no leaks exist.
3. Inspect filters lubricators and pressure regulators for proper operation.

END OF SECTION 221513

SECTION 22 31 00 - DOMESTIC WATER SOFTENERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Commercial water softeners.
   2. Chemicals.
   3. Water-testing sets.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water softeners.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
   3. Wiring Diagrams: For power, signal, and control wiring.

B. Field quality-control reports.

C. Operation and maintenance data.

D. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended application.

B. ASME Compliance for Steel Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, where indicated.

C. UL Compliance: Fabricate and label water softeners to comply with UL 979, "Water Treatment Appliances."

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water softeners that fail in materials or workmanship within specified warranty period.

   1. Water Softeners Warranty Period: From date of Substantial Completion.

a. Mineral Tanks: 10 years.
b. Brine Tanks: 10 years.

1.5 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Salt for Brine Tanks: Furnish in same form as and at least four times original load, but not less than 200 lb.
2. Store salt on raised platform where directed by Owner. Do not store in contact with concrete floor.

PART 2 - PRODUCTS

2.1 COMMERCIAL WATER SOFTENERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aquion Water Treatment Products.
2. Culligan International Company.
3. WaterSoft; a division of Amtrol, Inc.

B. Description: Factory-assembled, pressure-type water softener.

1. Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects."
2. Configuration: Twin unit with two mineral tanks and one brine tank.
3. Mounting: On skids.
4. Wetted Components: Suitable for water temperatures from 40 to at least 120 deg F.
5. Mineral Tanks: Stainless steel, electric welded; pressure-vessel quality.

a. Pressure Rating: 125 psig minimum.
b. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
c. Handholes: 4 inches round or 4 by 6 inches elliptical, in top head and lower sidewall of tanks.
d. Manhole: 11 by 15 inches in top head of tanks larger than 30 inches in diameter.
e. Support Legs or Skirt: Constructed of structural steel, welded to tank before testing and labeling.
f. Upper Distribution System: Single, point type, fabricated from galvanized-steel pipe and fittings.
g. Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from PVC pipe and fittings with individual, fine-slotted, nonclogging PE strainers, and arranged for even flow distribution through resin bed.
h. Liner: PE, ABS, or other material suitable for potable water.

6. Controls: Fully automatic; factory wired and factory mounted on unit.

a. Adjustable duration of various regeneration steps.
b. Push-button start and complete manual operation.
c. Electric time clock and switch for fully automatic operation, adjustable to initiate regeneration at any hour of day and any day of week or at fixed intervals.
d. Sequence of Operation: Multiport pilot-control valve automatically pressure-actuates main operating valve through steps of regeneration and return to service.
e. Pointer on pilot-control valve shall indicate cycle of operation.
f. Includes means of manual operation of pilot-control valve if power fails.

7. Main Operating Valves: Industrial, automatic, multiport, diaphragm type with the following features:

a. Slow opening and closing, nonslam operation.
b. Diaphragm guiding on full perimeter from fully open to fully closed.
c. Isolated, dissimilar metals within valve.
d. Self-adjusting, internal, automatic brine injector that draws brine and rinses at constant rate independent of pressure.
e. Valve for single mineral-tank unit with internal automatic bypass of raw water during regeneration.
f. Sampling cocks for soft water.
g. Special tools are not required for service.

8. Flow Control: Automatic, to control backwash and flush rates over wide variations in operating pressure; does not require field adjustments.

a. Demand-Initiated Control: Single mineral tank is equipped with automatic-reset-head water meter that electrically activates cycle controller to initiate regeneration at preset total in gallons. Head automatically resets to preset total in gallons for next service run.
b. Demand-Initiated Control: Each mineral tank of twin mineral-tank unit is equipped with automatic-reset-head water meter that electrically activates cycle controllers to initiate regeneration at preset total in gallons. Head automatically resets to preset total in gallons for next service run. Electrical lockout prevents simultaneous regeneration of both tanks.

9. Brine Tank: Combination measuring and wet-salt storing system.

a. Tank and Cover Material: Fiberglass, 3/16 inch thick; or molded PE, 3/8 inch thick.
b. Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawal and freshwater refill.
c. Size: Large enough for at least four regenerations at full salting.

10. Factory-Installed Accessories:

a. Piping, valves, tubing, and drains.
b. Sampling cocks.
c. Main-operating-valve position indicators.
d. Water meters.

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2.2 CHEMICALS

A. Mineral: High-capacity, sulfonated-polystyrene, ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock.

1. Exchange Capacity: 30,000 grains/cu. ft. of calcium carbonate of resin when regenerated with 15 lb of salt.

B. Salt for Brine Tanks: High-purity sodium chloride, free of dirt and foreign material. Rock and granulated forms are unacceptable.

1. Form: Processed, food-grade salt pellets.

2.3 WATER-TESTING SETS

A. Description: Manufacturer's standard water-hardness testing apparatus and chemicals with testing procedure instructions. Include metal container suitable for wall mounting.

PART 3 - EXECUTION

3.1 WATER SOFTENER INSTALLATION

A. Equipment Mounting: Install residential water softeners on floor.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.

B. Equipment Mounting: Install commercial water softeners on concrete base.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
5. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
6. Install anchor bolts to elevations required for proper attachment to supported equipment.
7. Anchor water softener and brine tanks to substrate.

C. Install brine lines and fittings furnished by equipment manufacturer but not specified to be factory installed.

D. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.

E. Install water-testing sets mounted on wall, unless otherwise indicated, and near water softeners.

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3.2 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to equipment, allow space for service and maintenance of equipment.

C. Install shutoff valves on raw-water inlet and soft-water outlet piping of each mineral tank, and on inlet and outlet headers.

1. Metal general-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
2. Plastic valves are specified in Division 22 Section "Domestic Water Piping."
3. Exception: Water softeners with factory-installed shutoff valves at locations indicated.

D. Install pressure gages on raw-water inlet and soft-water outlet piping of each mineral tank. Pressure gages are specified in Division 22 Section "Meters and Gages for Plumbing Piping."

1. Exception: Water softeners with factory-installed pressure gages at locations indicated.

E. Install drains as indirect wastes to spill into open drains or over floor drains.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

B. Add water to brine tanks and fill with the following form of salt:
1. Commercial Water Softeners: Processed, food-grade salt pellets.

C. Sample water softener effluent after startup and at three consecutive seven-day intervals (total of four samples), and prepare certified test reports for required water performance characteristics. Comply with the following:

1. ASTM D 859, "Test Method for Silica in Water."
2. ASTM D 1067, "Test Methods for Acidity or Alkalinity of Water."
3. ASTM D 1068, "Test Methods for Iron in Water."
4. ASTM D 1126, "Test Method for Hardness in Water."
5. ASTM D 1129, "Terminology Relating to Water."
6. ASTM D 3370, "Practices for Sampling Water from Closed Conduits."

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water softeners.

END OF SECTION 223100

SECTION 23 01 00 – GENERAL MECHANICAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section covers and applies to all work included in Divisions 21 through 25.

B. Work in this Section includes providing labor, materials, equipment, services necessary, fabrication, installation and testing for fully operational and safe systems including all necessary materials, appurtenances and features whether specified or shown in the contract documents or not, in conformity with all applicable codes and authorities having jurisdiction for the following:

1. Mechanical work covered by all sections within Divisions 21, 22, 23 and 25 of the specifications, including, but not limited to:

a. Heating, ventilating and air conditioning systems and equipment.

b. Plumbing systems and equipment.

c. Fire protection systems and equipment

d. Control systems.

e. Testing and balancing.

C. Provide cutting and patching, for the Mechanical Work.

D. Provide piping from plumbing terminations, 10 feet from equipment, for water, gas, sanitary sewer and waste.

E. Provide drain piping for all equipment requiring drainage to floor drains, roof, sink, or funnel drains.

1.3 RELATED WORK AND REQUIREMENTS

A. Carefully check the documents of each section with those of other sections and Divisions. Ascertain the requirements of any interfacing materials or equipment being furnished and/or installed by those sections and Divisions, and provide the proper installation and/or required interface.

1.4 QUALITY ASSURANCE

A. Supply all equipment and accessories in compliance with the applicable standards listed in article 1.6 of this section and with all applicable national, state and local codes.

B. All items of a given type shall be the products of the same manufacturer, unless otherwise specified herein.

1.5 SUBMITTALS

A. Submit shop drawings, product data, samples and certificates of compliance required by Division 01.

B. Product Data Submittals: Submit manufacturers standard published data. Mark each copy to identify applicable products, models, options, accessories and other data. Supplement manufacturers standard data to provide information specific to this project.

C. Organize submittals in sequence according to Specification Section. Submit in single electronic PDF document with tabs identifying each Specification Section. Provide Table of Contents identifying the Specification Sections being submitted and the contents within each tabbed section. Prepare Submittals in multiple volumes if required. Provide a complete Submittal package by Division at one time. Do not submit individual Sections piecemeal.

D. In addition to the submittal requirements of Divisions 21, 22, 23 and 25, submit product data for the following items per the provisions Division 01:

1. All Equipment and Fixtures indicated in Schedules on Drawings.

2. Access panels

E. If more than two submissions are required (initial submittal and one resubmittal) based on rejection or lack of compliance by submittal, then the Contractor shall:

1. Arrange for additional reviews by the Design Engineers.

2. Pay all costs for such additional reviews.

F. Corrections or comments made on the shop drawings during review do not relieve the Contractor from compliance with requirements of the drawings and specifications. Shop drawing checking by the Engineer is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is responsible for:

1. Confirming and correlating all quantities and dimensions.

2. Selecting fabrication processes and techniques of construction.

3. Coordinating his work with that of all other trades.

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4. Performing his work in a safe and satisfactory manner.

G. Substitutions:

1. Prior to Bid shall be in accordance with Division 01.

2. After award of contract, submit separate substitution request for each substitution in accordance with the requirements hereinbelow. Support each request with:

a. Complete data substantiating compliance of proposed substitution with requirements stated in Contract documents.

b. Data relating to changes in construction schedule.

c. Any effect of substitution on other Work in this and other Divisions, and any other related contracts, and changes required in other work or products.

3. Contractor shall be responsible at no extra cost to Owner for any changes resulting from proposed substitutions which affect work of other Sections or Divisions, or related contracts.

4. Claims for additional costs caused by substitution that may subsequently become apparent shall be met by the Contractor.

5. Failure by the Contractor to order materials or equipment in a timely manner will not constitute justification for a substitution.

6. Substitutions will not be considered for acceptance when acceptance will require revision of Contract Documents, unless Contractor bears cost of redesign.

a. Arrange for required redesign by Engineer.

b. Pay all costs for such redesign.

c. All subject to Architect's approval.

7. Approval of substitutions shall not relieve Contractor from full compliance with requirements of Contract documents.

H. As-built (Record) Drawings:

1. Shall be in accordance with Division 01.

2. Provide after installation is complete. Final signoff and Client acceptance will not occur prior to submission of As-built drawings to Architect/Engineer.

3. Indicate as-built conditions and all revisions, fully illustrating all revisions made by all trades in the course of work.

4. Dimension physical locations of ductwork, and piping with reference elevations

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and distances above finished floors, below beams, from wall faces, underground (invert elevations) and from column lines.

5. Exact location, type and function of concealed valves, dampers, controllers, piping, air vents, piping drains and isolators.

6. Indicate all equipment sizes and capacities and tag numbers.

7. Provide drawing on reproducible bond.

8. These drawings shall be for as-built record purposes for the Owner’s use and are not considered shop drawings.

I. Operating Instructions, Maintenance Manuals and Parts Lists:

1. Before requesting acceptance of work, submit one set for review by Architect/Engineer.

2. After review, furnish two (2) printed and bound sets.

3. Include:

a. Installers name, address, telephone number and representatives name, and website address.

b. Manufacturer's name, model number, service manual, spare-parts list, and descriptive literature for all components, cross referenced and numbered on Record Drawings, and in accordance with Title 24 as required.

c. Maintenance instructions.

d. Listing of possible breakdown and repairs.

e. Instruction for starting, operation and programming.

f. Detailed and simplified one line, color coded flow and wiring diagram.

g. Field test report, including:

1) Instrument set points.

2) Normal operating values.

h. Name, address and phone number of contractors equipment suppliers and service agencies.

i. Assemble manufacturer's equipment manuals in chronological order, following the specification alpha-numeric system, in heavy duty 3-ring binders clearly titled on the spine and front cover with appropriate index dividers.

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J. Special Tools:

1. One set of any special tools required to operate, adjust, dismantle or repair equipment furnished under any section of this Division.

2. "Special tools": those not normally found in possession of mechanics or maintenance personnel.

3. Tag each item and cross reference in Maintenance Manual.

4. Turn over to Owner's representative or temporarily secure to unit at Architect's instruction.

K. Quantity of Submittals Required:

1. Product Data (brochures):

a. Submit electronic PDF copy of product data.

b. If comments are required, comment sheet(s) will be returned with submittal.

2. Samples:

a. Submit as required in each specification section.

1.6 REFERENCE STANDARDS

A. Reference standards of industry organizations, manufacturer associates and professional associations that publish standards of construction and/or materials that are referenced in this Division are listed in Division 01. The Standards as referenced in this Specification shall be considered as attached and binding to the requirements of the Construction Documents. The Contractor is to be considered as knowledgeable of these Standards and their requirements for the performance of the Work.

1.7 CODE COMPLIANCE

A. In addition to complying with all other legal requirements, comply with current provisions of governing codes and regulations in effect during progress of the Work, and with the following:

1. Drawings and specification requirements shall govern where they exceed Code and Regulation requirements.

2. Where requirements between governing Codes and Regulations vary, the more restrictive provisions shall apply.

3. Nothing contained in Contract Documents shall be construed as authority or permission to disregard or violate legal requirements. The Contractor shall

immediately draw the attention of the Architect to any such conflicts noted in the Contract Documents.

1.8 DESCRIPTION OF BID DOCUMENTS

A. General:

1. Words or phrases such as "The Contractor shall," "shall be," "furnish," provide," “connect,” "a," "an," "the," and "all" etc. may be omitted for brevity.

2. The Drawings and Specifications are complimentary each to the other. Where discrepancies occur between the Drawings and Specifications, the more stringent provisions shall apply.

3. Examine all drawings and specifications prior to bidding the work. Report any discrepancies to the Engineer.

B. Specifications:

1. Specifications, in general, describe quality and character of materials and equipment and the Standards that govern. Contractor is responsible for design and construction costs incurred for equipment and materials other than the Basis of Design, including but not limited to architectural, structural, electrical, HVAC, fire sprinkler and plumbing.

2. Specifications are of simplified form and include incomplete sentences.

C. Drawings:

1. Drawings in general are diagrammatic and indicate scope, sizes, routing, locations, connections to equipment and methods of installation, but not necessarily offsets, obstructions or structural conditions. Drawings are not intended to show every item, fitting, transition or offset in its exact dimension or detail of equipment or proposed system layout. Locations on drawings may be distorted for purposes of clearness and legibility.

2. Contractor to provide additional offsets, fittings, hangers, supports, valves, drains as required for construction and coordination with work of other trades.

3. Before proceeding with work, ordering or fabricating materials, check and verify all dimensions and carefully check space requirements with other Work to ensure that all equipment and materials can be installed in spaces allotted.

4. Contractor to assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.

5. The Contractor is responsible for installing the work in such a manner that it will conform to the structure and architectural elements, avoid obstructions, maintain headroom, leave adequate clearance for proper maintenance and repairs, and

provide clearances and access required by codes. Do not scale distances off of mechanical drawings. Use actual field measured building dimensions.

6. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.

7. Above items to be performed at no additional cost to the Owner.

D. Typical details, where shown on the drawings, apply to each and every item of the project where such items are applicable. Typical details are not repeated in full on the plans, and are diagrammatic only, but with the intention that such details shall be incorporated in full.

1.9 DEFINITIONS

A. "Piping": pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.

B. "Motor Controllers": manual or magnetic starters (with or without switches), individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.

C. "Control" or "Actuating Devices": automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

1.10 JOB CONDITIONS

A. Adjoining work of other Divisions shall be examined for interferences and conditions affecting this Division.

B. Examine site related work and surfaces before starting work of any Section.

1. Report to Architect, in writing, conditions which will prevent proper provision of this work.

2. Beginning work of any Section without reporting unsuitable conditions to Architect constitutes acceptance of conditions by Contractor.

3. Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to Owner.

C. Connections to existing work.

1. Unknown conditions will be addressed if reasonable.

2. Contractor shall field verify existing dimensions prior to ordering or fabricating materials.

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3. Install new work and connect to existing work with minimum interference to existing facilities.

4. Temporary shutdowns of existing services:

   a. At no additional charges.

   b. At times not to interfere with normal operation of existing facilities.

   c. Provide 48 hour notification.

5. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work.

6. Restore existing disturbed work to original condition.

D. Removal and relocation of existing work.

1. Disconnect, remove or relocate material, equipment, plumbing fixtures, piping and other work noted and required by removal or changes in existing construction.

2. Where existing pipes, conduits and/or ducts which are to remain prevent installation of new work as indicated, relocate, or arrange for relocation, of existing pipes, conduits and/or ducts.

3. Provide new material and equipment required for relocated equipment.

4. Plug or cap active piping or ductwork behind or below finish.

5. Do not leave long dead-end branches. Cap or plug as close as possible to active line.

6. Remove unused piping, ductwork and material.

7. Dispose of removed fixtures and equipment as directed.

8. Turn over removed fixtures and equipment to Owner as directed.

E. Special Traffic Requirements:

1. Maintain emergency and service entrances useable to pedestrian, truck, and ambulance traffic at all times.

2. Where trenches are cut, provide adequate bridging for above-mentioned traffic.

1.11 TEMPORARY FACILITIES

A. See Division 01 for temporary facilities required.

1.12 SCHEDULE OF WORK

A. Arrange work to conform to schedule of construction established or required to comply with Contract Documents.

B. In scheduling, anticipate means of installing equipment through available openings in structure.

C. Confirm in writing to Architect, within 30 days of signing of contract, anticipated number of days required to perform test, balance, and acceptance testing of mechanical systems:

1. This phase must occur after completion of mechanical systems, including all control calibration and adjustment, and requires substantial completion of the building, including closure, ceilings, lighting, partitioning, etc.

2. Submit for approval at this time, names and qualifications of test and balancing agencies to be used.

1.13 NOISE REDUCTION

A. Cooperate in reducing objectionable noise or vibration caused by mechanical systems.

1. To extent of adjustments to specified and installed equipment and appurtenances.

B. Correct noise problems caused by failure to install work in accordance with Contract Documents. Include labor and materials required as result of such failure.

PART 2 - PRODUCTS

2.1 ACCESS DOORS

A. Size for proper access, adjusting and maintenance:

1. 12 in. x 12 in. minimum for valves, trap primers, shock absorbers, etc.

2. 24 in. x 24 in. for man access to concealed fans, coils, etc., unless indicated otherwise.

B. Provide as required by work in this Division.

C. Style, Color and Finish to match adjacent construction and as approved by Architect.

PART 3 - EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of the particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.2 CUTTING AND PATCHING

A. All carpentry, cutting and patching to be done under trades doing that work. Work shall be done in accordance with Division 01.

B. Provide all carpentry, cutting and patching required for proper installation of material and equipment specified in Divisions 21, 22, 23 and 25.

C. Do not cut, notch or drill structural members without consent of Architect.

D. All cutting and repairing shall conform to Title 21 of California Administrative Code.

3.3 CONCRETE ANCHORS

A. Steel bolt with expansion anchor requiring a drilled hole – powder driven anchors are not acceptable.

B. Minimum concrete embedment shall be 4-1/2 diameters unless otherwise noted on plans.

C. Minimum spacing shall be 12 diameters center to center and 6 diameters center to edge of concrete unless otherwise noted on plans.

D. Maximum allowable stresses for tension and shear shall be 80% of the ICBO test report values. Hilti, Phillips, Wej-It.

3.4 EQUIPMENT ANCHORING

A. All equipment shall be securely anchored in accordance with CBC.

B. All equipment mounted on concrete shall be secured with a concrete anchor as specified above at each mounting point.

C. Secure base plate as indicated above.

3.5 SUPPORTS AND SEISMIC RESTRAINTS

A. All mechanical systems (all ductwork, piping, etc.) shall be provided with supports and seismic restraints in accordance with Seismic Hazard Level ‘A’ of the “Guidelines for Seismic Restraint Manual: Guidelines for Mechanical Systems”, current issue, as published by the Sheet Metal and Air Conditioning Contractors National Association,

Inc. (SMACNA), Chantilly, Virginia and in accordance with CBC.

3.6 WATER PROOFING

A. Under General Construction Work.

B. Where any work pierces waterproofing, installation shall be subject to review.

1. Provide all necessary sleeves, caulking, flashing and flashing fittings required to make openings absolutely watertight.

C. Flashing:

1. Mechanical Contractor shall provide flashing for all work in this Division, unless otherwise provided by roofing installer, as required to accommodate roof slope, roofing material, and roof installation method. No additional costs will be paid for lack of familiarity of Contractor with roofing type or slope.

2. Mechanical Contractor shall be responsible for coordinating size of penetrations and locations with roofing contractor.

3. Mechanical Contractor shall be responsible for scheduling installation of piping and other penetrations through roof structural system to exterior that they are complete and secure for the orderly installation of the roofing system.

4. 4 lb. lead.

5. 16 oz. lead coated copper.

6. No.22 USSG aluminum.

7. Fittings for piping through roof:

a. Galvanized cast iron bottom recess roof type.

b. Similar to Josam No. 26440 or No. 26450.

D. Provide weather protection canopies, hoods or enclosures over out-of-door equipment which could be damaged by exposure to weather.

1. This requirement applies to:

a. Motors and drives.

b. Controls.

c. Instruments.

2. Identify items under such covers if entirely enclosed.

3.7 ACCESS TO VALVES AND EQUIPMENT

A. Access shall be possible where valves, expansion joints, fire dampers, motors, filters, control devices, and any other equipment requiring access for servicing, repairs, or maintenance are located in walls, soffits, chases, and/or above ceilings.

B. Definition of Accessible:

1. Valves and dampers may be operated.

2. Control devices may be adjusted.

3. Fire dampers may be reset.

4. Equipment access panels may be opened.

5. Normal maintenance work such as replacement of filters, lubrication of bearings, etc., may be performed readily within arm's reach of access opening.

6. It shall not be necessary to crawl through furred ceiling space to perform such operations.

C. Install piping, equipment and accessories to permit easy access for maintenance.

D. Group concealed valves, expansion joints, controls, dampers and equipment requiring service access, so as to be freely accessible through access doors and to minimize the number of access doors required.

E. Relocate piping equipment and accessories as required, at no extra cost to afford proper maintenance access.

F. Coordinate location of access panels with applicable trades installing walls or ceiling.

1. Coordinate panel locations with lights and other architectural features.

2. Submit proposed panel locations to Architect for review.

G. Arrange for location and marking of removable tiles in splined ceilings where access panels are not installed.

H. Existing Structures:

1. When installation requires access openings through existing construction, coordinate location of necessary access panels, and arrange for respective trades to provide openings and framing which may be required.

2. Restore adjoining existing surfaces to original condition after new access panels have been installed.

3.8 CLEANING AND ADJUSTING

A. Work to be painted: Brush and clean work prior to concealing, painting and acceptance. Perform in stages if directed.

B. Painted or exposed work soiled or damaged: Clean, repair and paint to match adjoining work before final acceptance.

C. Remove debris from inside and outside of materials and equipment.

D. Flush out piping after installation.

E. Adjust valves and automatic control devices.

F. Traps, wastes and supplies: unobstructed.

3.9 FIELD QUALITY CONTROL

A. Refer to Division 01.

B. Tests:

1. Perform as specified in individual Divisions, and as required by authorities having jurisdiction.

C. Furnish written report and certification that tests have been satisfactorily completed.

D. Repair or replace defective work, as directed.

E. Pay for restoring or replacing damaged work due to tests, as directed.

F. Pay for restoring or replacing damaged work of others, due to tests, as directed.

3.10 TRAINING

A. Provide training by qualified manufacturers' representatives for equipment as specified in this Division.

B. Training to include:

1. Site-specific training.

2. Minimum hours as specified in each Section.

3. Training materials (minimum six sets).

4. Electronic media available from the manufacturer [two (2) copies].

C. Each training session to be scheduled with Owner at least 30 days in advance.

END OF SECTION

SECTION 23 05 00 – COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Mechanical sleeve seals.
3. Sleeves.
4. Escutcheons.
5. Equipment installation requirements common to equipment sections.
6. Painting and finishing.
7. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Mechanical sleeve seals.
2. Access doors

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Carbon steel or Stainless steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. PVC Pipe: ASTM D 1785, Schedule 40.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

2.7 ACCESS DOORS

A. Size for proper access, adjusting and maintenance:

1. 12 in. x 12 in. minimum for valves, volume dampers, etc.
2. 24 in. x 24 in. for man access to concealed fans, coils, fire/smoke dampers, etc., unless indicated otherwise.

B. Provide as required by work in Division 21, 22, 23, and 25.

C. Style, color, and finish to match adjacent construction and as approved by Architect.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Sleeves are not required for core-drilled holes.

N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

    a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6.

        1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.

O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten

bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2-1/2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 ACCESS TO VALVE AND EQUIPMENT

A. Access shall be possible where valves, expansion joints, fire dampers, motors, filters, control devices, and any other equipment requiring access for servicing, repairs, or maintenance are located in walls, soffits, chases, and/or above ceilings.

B. Definition of Accessible:

1. Valves and dampers may be operated.
2. Control devices may be adjusted.
3. Fire dampers may be reset.
4. Equipment access panels may be opened.
5. Normal maintenance work such as replacement of filters, lubrication of bearings, etc., may be performed readily within arm's reach of access opening.
6. It shall not be necessary to crawl through furred ceiling space to perform such operations.

C. Install piping, equipment and accessories to permit easy access for maintenance.

D. Group concealed valves, expansion joints, controls, dampers and equipment requiring service access, so as to be freely accessible through access doors and to minimize the number of access doors required.

E. Relocate piping equipment and accessories as required, at no extra cost to afford proper maintenance access.

F. Coordinate location of access panels with applicable trades installing walls or ceiling.

1. Coordinate panel locations with lights and other architectural features.
2. Submit proposed panel locations to Architect for review.

G. Arrange for location and marking of removable tiles in splined ceilings where access panels are not installed.

3.6 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION

SECTION 23 05 13 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

A. Insulation: Class F.

B. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

C. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

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2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be DC electronic commutation type (ECM) specifically designed for fan applications. Prewired to the specific voltage and phase. Internal motor shall convert AC supplied to the fan to DC power to operate the motor. Motor shall be controllable down to 20% of full speed. Speed shall be controlled by either potentiometer dial mounted on the motor or by a 0-10 VDC signal. Motor shall be a minimum of 85% efficient at all speeds.

B. Bearings: Permanently lubricated, heavy duty ball bearings suitable for radial and thrust loading.

C. Motors 1/20 HP and Smaller: Shaded-pole type.

D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 23 05 19 – METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Filled-system thermometers.
3. Liquid-in-glass thermometers.
4. Thermowells.
5. Dial-type pressure gages.
6. Gage attachments.
7. Test plugs.
8. Test-plug kits.
9. Sight flow indicators.
10. Orifice flowmeters.
11. Pitot-tube flowmeters.
12. Turbine flowmeters.
13. Venturi flowmeters.
14. Vortex-shedding flowmeters.
15. Impeller-turbine, thermal-energy meters.
16. Ultrasonic, thermal-energy meters.

B. Related Sections:

1. Division 23 Section "Facility Natural-Gas Piping" for gas meters.
2. Division 23 Section "Steam and Condensate Heating Piping" for steam and condensate meters.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Product Certificates: For each type of meter and gage, from manufacturer.

D. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Trerice, H. O. Co.
2. Tel-Tru Manufacturing Company.
3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
4. Weiss Instruments, Inc.
5. WIKA Instrument Corporation - USA.

B. Standard: ASME B40.200.

C. Case: Hermetically sealed type(s); stainless steel with 3-inch nominal diameter.

D. Dial: Nonreflective aluminum white background with permanently etched black and blue scale markings and scales in deg F and deg C.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Double strength glass].

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Trerice, H. O. Co.
b. Tel-Tru Manufacturing Company.
c. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
d. Weiss Instruments, Inc.
e. WIKA Instrument Corporation - USA.

2. Standard: ASME B40.200.

3. Case: Cast aluminum; 9-inch nominal size.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue organic liquid.
6. Tube Background: Nonreflective aluminum white background with permanently etched black scale markings graduated in deg F and deg C.
7. Window: Glass or Ultraviolet protective acrylic.
8. Stem: Aluminum or brass and of length to suit installation.
   a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inch, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division.

2.3 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Trerice, H. O. Co.
   b. AMETEK, Inc.; U.S. Gauge.
   c. Flo Fab Inc.
   d. Tel-Tru Manufacturing Company.
   e. Trerice, H. O. Co.
   f. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   g. Weiss Instruments, Inc.
   h. WIKA Instrument Corporation - USA.
   i. Winters Instruments - U.S.
2. Standard: ASME B40.100.

3. Case: Liquid-filled type(s); stainless steel>; 4-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum white background with permanently etched black scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Laminated Safety Glass.
10. Ring: Stainless steel.
11. Accuracy: [Grade 1A, plus or minus 1 percent of full scale range.

2.5 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of brass or stainless-steel pipe with NPS 1/4 or NPS 1/2 pipe threads.

C. Valves: Brass ball or Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.6 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.7 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Furnish two test-plug kit(s) containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

D. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch diameter dial and probe. Dial range shall be at least 0 to 200 psig.

E. Carrying Case: Metal or plastic, with formed instrument padding.

2.8 FLOWMETERS

A. Turbine Flowmeters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ONICON Incorporated.
    b. ABB; Instrumentation and Analytical.
    c. Data Industrial Corp.
    d. EMCO Flow Systems; a division of Spirax Sarco, Inc.
    e. ERDCO Engineering Corp.
    f. Hoffer Flow Controls, Inc.
    g. Liquid Controls; a unit of IDEX Corporation.
    h. McCrometer, Inc.
    i. Midwest Instruments & Controls Corp.
    j. SeaMetrics, Inc.

2. Description: Flowmeter with sensor and indicator.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Impeller turbine; for inserting into pipe fitting or for installing in piping and measuring flow directly in gallons per minute.

a. Design: Device or pipe fitting with inline turbine and integral direct-reading scale for water].
b. Construction: Bronze or stainless-steel body, with plastic turbine or impeller.
c. Minimum Pressure Rating: 150 psig.
d. Minimum Temperature Rating: 300 deg F.

5. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
6. Accuracy: Plus or minus 1-1/2 percent from 3-30 ft/sec.
7. Display: Shows rate of flow.
8. Operating Instructions: Include complete instructions with each flowmeter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids (except steam).

H. Install valve and syphon fitting in piping for each pressure gage for steam.

I. Install test plugs in piping tees.

J. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

K. Install flowmeter elements in accessible positions in piping systems.

L. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

M. Install permanent indicators on walls or brackets in accessible and readable positions.

N. Install connection fittings in accessible locations for attachment to portable indicators.

O. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler.
3. Inlet and outlet of each hydronic coil in air-handling units.
4. Two inlets and two outlets of each hydronic heat exchanger.
5. Inlet and outlet of each thermal-storage tank.
6. Refer to plans for additional locations.

P. Install pressure gages in the following locations:

1. Discharge of each pressure-reducing valve.
2. Suction and discharge of each pump.
3. Refer to plans for additional locations.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each hydronic zone shall be the following:
1. Industrial-style, liquid-in-glass type.
2. Test plug with EPDM self-sealing rubber inserts.

B. Thermometers at inlet and outlet of each hydronic boiler shall be the following:
1. Industrial-style, liquid-in-glass type.
2. Test plug with EPDM self-sealing rubber inserts.

C. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.
3. Test plug with EPDM self-sealing rubber inserts.

D. Thermometers at inlets and outlets of each hydronic heat exchanger shall be one of the following:

1. Sealed, bimetallic-actuated type.

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2. Industrial-style, liquid-in-glass type.
3. Test plug with EPDM self-sealing rubber inserts.

E. Thermometers at inlet and outlet of each thermal-storage tank shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.
3. Test plug with EPDM self-sealing rubber inserts.

F. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 30 to 240 deg F and 0 to plus 115 deg C.

B. Scale Range for Steam and Steam-Condensate Piping: 50 to 400 deg F and 0 to 200 deg C.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each pressure-reducing valve shall be the following:

1. Liquid-filled, direct-mounted, metal case.
2. Test plug with EPDM self-sealing rubber inserts.

B. Pressure gages at suction and discharge of each pump shall be the following:

1. Liquid-filled, direct-mounted, metal case.
2. Test plug with EPDM self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 0 to 100 psi.

B. Scale Range for Steam Piping: 0 to 100 psi.

END OF SECTION

SECTION 23 05 29 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE 7-16.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

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2.4 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
3. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
4. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
5. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. C-Clamps (MSS Type 23): For structural shapes.
5. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 23 05 48 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Elastomeric hangers.
5. Spring hangers.
6. Spring hangers with vertical-limit stops.
7. Pipe riser resilient supports.
8. Resilient pipe guides.
9. Seismic snubbers.
10. Restraining braces and cables.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. As indicated on the Contract Drawings.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.

a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Division 22 Sections for equipment mounted outdoors.

2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
4. Seismic-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Division 22 Sections for equipment mounted outdoors.
d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

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E. Qualification Data: For professional engineer.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

C. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

D. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

F. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

G. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

H. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

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1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

I. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch-thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

J. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch-thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 SEISMIC-RESTRAINT DEVICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti, Inc.
5. Kinetics Noise Control.
6. Loos & Co.; Cableware Division.
7. Mason Industries.
8. TOLCO Incorporated; a brand of NIBCO INC.
9. Unistrut; Tyco International, Ltd.

C. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

D. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.

E. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

F. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

G. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

H. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

I. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

J. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

K. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

L. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

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3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

D. Install cables so they do not bend across edges of adjacent equipment or building structure.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

I. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one

supporting the connections as they approach equipment. Comply with requirements in Division 22 Section "Hydronic Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust air-spring leveling mechanism.

D. Adjust active height of spring isolators.

E. Adjust restraints to permit free movement of equipment within normal mode of operation.

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3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Division 01 Section "Demonstration And Training."

END OF SECTION

SECTION 23 05 53 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-mm) minimum thickness and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/2 inch (13 mm). Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/2 inch (13 mm). Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.

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C. Label Content: Include equipment's Drawing designation or unique equipment number, and Room number of primary space served (where thermostat is located). Coordinate with District to match final installed room numbering.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, and pipe size.
   1. Lettering Size: At least 1-1/2 inches (38 mm) high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 20 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.

C. Pipe Label Color Schedule:

1. Refrigerant Piping:

    a. Background Color: Yellow.
    b. Letter Color: Black.

END OF SECTION

SECTION 23 05 93 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Variable-air-volume air systems.
b. Constant-volume systems.

2. Building Flush-Out Requirements

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 SUBMITTALS

A. Certified TAB reports.

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC NEBB or TABB with a minimum of 15 years of successful testing, adjusting, and balancing experience.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC NEBB or TABB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC NEBB or TABB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.5 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.6 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

K. Examine operating safety interlocks and controls on HVAC equipment.

L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
6. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in ASHRAE 111 and in this Section.

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.9 PROCEDURES FOR BUILDING FLUSH-OUT

A. Refer to Section 230500 Common Work Results for HVAC for building flush-out requirements.

B. Building flush-out must be complete after completion of Test and Balance procedures.

3.10 TOLERANCES

A. Set HVAC system's air flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Outside Air Rates: Plus or minus 10 percent.

3.11 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.12 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Terminal units.
4. Balancing stations.
5. Position of balancing devices.

END OF SECTION

SECTION 23 07 00 – HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

    a. Calcium silicate.
    b. Cellular glass.
    c. Flexible elastomeric.
    d. Mineral fiber.

2. Fire-rated insulation systems.
3. Insulating cements.
4. Adhesives.
5. Mastics.
6. Lagging adhesives.
7. Sealants.
8. Factory-applied jackets.
9. Field-applied fabric-reinforcing mesh.
10. Field-applied cloths.
11. Field-applied jackets.
12. Tapes.
13. Securements.
14. Corner angles.

B. Related Sections:

1. Division 21 Section "Fire-Suppression Systems Insulation."
2. Division 22 Section "Plumbing Insulation."
3. Division 23 Section "Metal Ducts" for duct liners.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

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1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

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PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Calcium Silicate:

1. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
2. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
3. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

G. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Cell-U-Foam Corporation; Ultra-CUF.
    b. Pittsburgh Corning Corporation; Foamglas Super K.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

H. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

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1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Aeroflex USA Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

I. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. CertainTeed Corp.; Duct Wrap.
    b. Johns Manville; Microlite.
    c. Knauf Insulation; Duct Wrap.
    d. Manson Insulation Inc.; Alley Wrap.
    e. Owens Corning; All-Service Duct Wrap.

J. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Fibrex Insulations Inc.; Coreplus 1200.
    b. Johns Manville; Micro-Lok.
    c. Knauf Insulation; 1000 Pipe Insulation.
    d. Manson Insulation Inc.; Alley-K.
    e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

K. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. CertainTeed Corp.; CrimpWrap.
    b. Johns Manville; MicroFlex.
    c. Knauf Insulation; Pipe and Tank Insulation.

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d. Manson Insulation Inc.; AK Flex.
e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-52.
b. Foster Products Corporation, H. B. Fuller Company; 81-42.
c. Marathon Industries, Inc.; 130.
d. Mon-Eco Industries, Inc.; 11-30.
e. Vimasco Corporation; 136.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F.
4. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-76-8.
b. Foster Products Corporation, H. B. Fuller Company; 95-44.

c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.

B. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto PVC Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.
e. <Insert manufacturer's name; product name or designation.>

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Color-code jackets based on system within Central Plant. Color as selected by Architect. All other areas to be white.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

5. Factory-fabricated tank heads and tank side panels.

D. Metal Jacket:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; Metal Jacketing Systems.
    b. PABCO Metals Corporation; Surefit.
    c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
    a. Finish and thickness are indicated in field-applied jacket schedules.
    b. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper
    c. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
    d. Factory-Fabricated Fitting Covers:

        1) Same material, finish, and thickness as jacket.
        2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.
        8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

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2.12 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products; Bands.
    b. PABCO Metals Corporation; Bands.
    c. RPR Products, Inc.; Bands.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with closed seal.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated.

    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

        1) AGM Industries, Inc.; CWP-1.
        2) GEMCO; CD.
        3) Midwest Fasteners, Inc.; CD.
        4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

    a. Products: Subject to compliance with requirements, [available products that may be incorporated into the Work include, but are not limited to, the following:

        1) AGM Industries, Inc.; CWP-1.
        2) GEMCO; Cupped Head Weld Pin.
        3) Midwest Fasteners, Inc.; Cupped Head.
        4) Nelson Stud Welding; CHP.

3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

        1) AGM Industries, Inc.; RC-150.
        2) GEMCO; R-150.
        3) Midwest Fasteners, Inc.; WA-150.
        4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

2.13 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

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3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches] [4 inches] o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation,

install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

a. Do not weld anchor pins to ASME-labeled pressure vessels.
b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
d. Do not overcompress insulation during installation.
e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
f. Impale insulation over anchor pins and attach speed washers.

g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

C. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch-diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from aluminum, at least 0.050 inch thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.6 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe

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insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

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3. Install insulation to flanges as specified for flange insulation application.

3.8 MINERAL-FIBER INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

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7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in nonconditioned space.
4. Indoor, exposed return located in nonconditioned space.

B. Items Not Insulated:
1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

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3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. Ft nominal density.

B. Concealed, round and flat-oval, return-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. Ft nominal density.

C. Concealed, round and flat-oval, outdoor-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

D. Concealed, rectangular, supply-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. Ft nominal density.

E. Concealed, rectangular, return-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. Ft nominal density.

F. Concealed, rectangular, outdoor-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

3.12 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Chillers: Insulate cold surfaces on chillers, including, but not limited to, evaporator bundles, condenser bundles, suction piping, compressor inlets, tube sheets, water boxes, and nozzles with the following:
   1. Flexible Elastomeric: 1 inch thick.

D. Dual Temp Water pump insulation shall be the following:
   1. Flexible Elastomeric: 1.5 inch thick.

E. Dual Temp Water expansion tank and buffer tank insulation shall be one of the following:

   1. Calcium Silicate: 2 inches thick.

F. Dual Temp Water air-separator insulation shall be the following:

   1. Cellular Glass: 1-1/2 inches thick.
   2. Flexible Elastomeric: 1 inch thick.

3.13 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.14 INDOOR PIPING INSULATION SCHEDULE

A. Dual Temp Water Supply and Return:

1. NPS 2-1/2 and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.

2. NPS 3 and larger: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

3.15 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Dual Temp Water Supply and Return:

1. All Pipe Sizes: Insulation shall be the following:

   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

B. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

3.16 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. None.

D. Piping, Concealed:

1. PVC: 20 mil thick

E. Piping, Exposed:

1. PVC: 20 mil thick

3.17 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
   1. Aluminum, Smooth: 0.020 inch thick.

D. Piping, Exposed:
   1. Aluminum, Smooth: 0.020 inch thick.

END OF SECTION

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SECTION 23 08 00 – COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.3 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority.

C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.

D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 ALLOWANCES

A. Labor, instrumentation, tools, and equipment costs for technicians for the performance of commissioning testing shall be covered by the Commissioning Authority.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

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E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.6 CxA'S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing, adjusting, and balancing of Work are complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.7 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
5. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing, adjusting, and balancing reports.

1.8 SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, prestart, and startup activities.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 TESTING AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least 10 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.

1. The CxA will notify testing and balancing Contractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
2. The testing and balancing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.

4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the HVAC&R Contractor, testing and balancing Contractor and HVAC&R Instrumentation and Control Contractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 25 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls." Assist the CxA with preparation of testing plans.

B. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

C. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

END OF SECTION

SECTION 23 09 23 - Direct-Digital Control System

Part 1 – General

1.A Related Documents

1. All work of this Division shall be coordinated and provided by the single BMS Contractor.
2. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the applicable sections for details.
3. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.
4. If the BMS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

1.B Definitions

1. Analog: A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values.
2. Binary: A two-state system where an “on” condition is represented by one discrete signal level and an “Off” condition is represented by a second discrete signal level.
3. BMS: The total integrated system of fully operational and functional elements, including equipment, software, programming, and associated materials, to be provided by this Division BMS Contractor and to be interfaced to the associated work of other related trades.
4. BMS Contractor: The single Contractor to provide the work of this Division. This Contractor shall be the primary manufacturer, installer, commissioner and ongoing service provider for the BMS work.
5. Control Sequence: A BMS pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.
6. Direct Digital Control: The digital algorithms and pre-defined arrangements included in the BMS software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative and Integral control algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.
7. BMS Network: The total digital on-line real-time interconnected configuration of BMS digital processing units, workstations, panels, sub-panels, controllers, devices and associated elements individually known as network nodes. May exist as one or more fully interfaced and integrated sub-networks, LAN, WAN or the like.
8. Node: A digitally programmable entity existing on the BMS network.
9. BMS Integration: The complete functional and operational interconnection and interfacing of all BMS work elements and nodes in compliance with all applicable codes, standards and ordinances to provide a single coherent BMS as required by this Division.
10. Provide: The term “Provide” and its derivatives when used in this Division shall mean to furnish, install in place, connect, calibrate, test, commission, warrant, document and supply the associated required services ready for operation.

11. PC: Personal Computer from a recognized major manufacturer or a virtual equivalent provided by, or with the consent of the owner.
12. Furnish: The term “Furnish” and its derivatives when used in this Division shall mean supply at the BMS Contractor’s expense to the designated third party trade contractor for installation. BMS Contractor shall connect furnished items to the BMS, calibrate, test, commission, warrant and document.
13. Wiring: The term “Wiring” and its derivatives when used in this Division shall mean provide the BMS wiring and terminations.
14. Install: The term “Install” and its derivatives when used in this Division shall mean receive at the jobsite and mount.
15. Protocol: The term “protocol” and its derivatives when used in this Division shall mean a defined set of rules and standards governing the on-line exchange of data between BMS network nodes.
16. Software: The term “software” and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the BMS industry for real-time, on-line, integrated BMS configurations.
17. The use of words in the singular in these Division documents shall not be considered as limiting when other indications in these documents denote that more than one such item is being referenced.
18. Headings, paragraph numbers, titles, shading, bolding, underscores, clouds and other symbolic interpretation aids included in the Division documents are for general information only and are to assist in the reading and interpretation of these Documents.
19. The following abbreviations and acronyms may be used in describing the work of this Division:

AHJ	Authority Having Jurisdiction
AI	Analog Input
AO	Analog Output
AWG	American Wire Gauge
BTL	BACnet® Testing Laboratories
CPU	Central Processing Unit
DDC	Direct Digital Control
DI	Digital Input
DO	Digital Output
EEPROM	Electronically Erasable Programmable Read Only Memory
EMI	Electromagnetic Interference
HD	High Definition
HOA	Hand-Off-Auto
I/O	Input/Output

IT	Information Technology
LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MCC	Motor Control Center
NC	Normally Closed
NO	Normally Open
OAT	Outdoor Air Temperature
OEM	Original Equipment Manufacturer (Private label)
OWS	Operator Workstation
PC	Personal Computer
ppm	parts per million
RAM	Random Access Memory
RF	Radio Frequency
RFI	Radio Frequency Interference
RH	Relative Humidity
ROM	Read Only Memory
RTD	Resistance Temperature Device
TCP/IP	Transmission Control Protocol/Internet Protocol
UPS	Uninterruptible Power Supply
VAC	Volts, Alternating Current
VAV	Variable Air Volume
VDC	Volts, Direct Current
VPN	Virtual Private Network
VSD	Variable Speed Drive
WAN	Wide Area Network

1.C BMS System Description

1. The BMS shall be a complete system designed for use with the enterprise IT systems. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the BMS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.
2. Any and all components of the BMS that are connected via field bus or IP network, including the network controllers, field controllers, application specific controllers, server and user interface software, system and controller programming tools and software applications shall be

designed, engineered, and tested to work together as a complete building management system, and shall be manufactured by the same BMS manufacturer.

3. All points of user interface shall be on standard computing devices that do not require the purchase of any special software from the BMS manufacturer for use as a building operations terminal. The primary point of interface on these devices will be a standard Web Browser.
4. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.
5. Manage and coordinate the BMS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as not to impede or delay the work of associated trades.
6. The BMS as provided shall incorporate, at minimum, the following integrated features, functions and services:
    a. Operator information, alarm management and control functions
    b. Information management including monitoring, transmission, archiving, retrieval, and reporting functions
    c. Diagnostic monitoring and reporting of BMS functions
    d. Energy management
    e. Standard applications for terminal HVAC systems
    f. Enterprise-wide information and control access
    g. Offsite monitoring and management access
    h. Fault Detection and Fault Triage

1.D Quality Assurance

1. General
    a. The BMS Contractor shall have a branch facility within a 100-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis. The BMS Contractor shall have, at this facility, a trained, directly employed and full time technical staff, spare parts inventory, and all necessary test and diagnostic equipment.
    b. As evidence and assurance of the contractor’s ability to support the Owner's system with service and parts, the contractor must have been in the BMS business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.
    c. The BMS architecture shall consist of the products of a manufacturer regularly engaged in the production of BMS, and shall be the manufacturer’s latest standard of design at the time of bid.

1.E References

1. All work shall conform to the following Codes and Standards, as applicable:
   a. National Fire Protection Association (NFPA) Standards
   b. National Electric Code (NEC) and applicable local Electric Code
   c. UL listing and labels
   d. UL 864 10th Edition UUKL Smoke Control (for USA and Canada)
   e. UL 268 Smoke Detectors
   f. UL 916 Energy Management
   g. NFPA 70 – National Electrical Code
   h. NFPA 90A – Standard For The Installation Of Air Conditioning And Ventilating Systems
   i. NFPA 92A and 92B Smoke Purge/Control Equipment
   j. Factory Mutual (FM)
   k. American National Standards Institute (ANSI)
   l. National Electric Manufacturer's Association (NEMA)
   m. American Society of Mechanical Engineers (ASME)
   n. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
   o. Air Movement and Control Association (AMCA)
   p. Institute of Electrical and Electronic Engineers (IEEE)
   q. American Standard Code for Information Interchange (ASCII)
   r. Electronics Industries Association (EIA)
   s. Occupational Safety and Health Administration (OSHA)
   t. American Society for Testing and Materials (ASTM)
   u. Federal Communications Commission (FCC) including Part 15, RF Devices
   v. Americans Disability Act (ADA)
   w. ANSI/EIA 909.1-A-1999 (LonWorks®)
   x. ANSI/ASHRAE Standard 195 (BACnet)
2. In the case of conflicts or discrepancies, the more stringent regulation shall apply.
3. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.F Work By Others

1. The demarcation of work and responsibilities between the BMS Contractor and other related trades shall be as outlined in the BMS RESPONSIBILITY MATRIX.

BMS Responsibility Matrix

Work	Furnish	Install	Low Volt. Wiring/Tube	Line Power
BMS low voltage and communication wiring *[1] (note 1)	BMS	BMS	BMS	N/A

Work	Furnish	Install	Low Volt. Wiring/Tube	Line Power
Fan Coil Unit controls	BMS	BMS	BMS	26
BMS conduits and raceway	BMS	BMS	BMS	BMS
Automatic dampers at Fan Coils (non-factory)	23	23	BMS	N/A
Automatic valves	BMS	23	BMS	N/A
Pipe insertion devices and taps including thermowells, flow and pressure stations.	BMS	23	BMS	BMS
BMS Current Switches.	BMS	BMS	BMS	N/A
BMS Control Relays	BMS	BMS	BMS	N/A
BMS interface with Chiller controls	BMS	BMS	BMS	BMS
BMS interface with Boiler controls	BMS	BMS	BMS	BMS
BMS interface with existing BMS Server	BMS	BMS	BMS	BMS
All BMS Nodes, equipment, housings, enclosures and panels.	BMS	BMS	BMS	BMS
Smoke Detectors (note 4)	23	23	BMS	26
Fire/Smoke Dampers (note 5)	23	23	BMS*[1]	26
Fire Dampers	23	23	N/A	N/A
VFDs	23	26	BMS	26
Fire Alarm shutdown relay interlock wiring	26	26	26	26
Fire Alarm smoke control relay interlock wiring	26	26	BMS	26
Fireman’s Smoke Control Override Panel	26	26	26	26
Packaged RTU space mounted controls	BMS	BMS	BMS	26
Packaged RTU factory-mounted controls	23	23	BMS	26
Packaged RTU field-mounted controls	BMS	BMS	BMS	26
Starters, HOA switches	26	26	N/A	26
Control damper actuators	BMS	BMS	BMS	26

Footnotes:

*1. Fire/Smoke Dampers: BMS Contractor to provide and ensure OPEN/CLOSE control of Fire/Smoke dampers as coordinated between BMS HVAC systems sequences, controls and overrides, and the Fire Alarm system control status priorities and overrides. Coordinate with Division 26 to provide fire alarm control modules for air handling unit and exhaust system shutdown and smoke control inputs to the DDC

system. Ensure that the logic matrix for the fire alarm devices to trigger a HVAC response is clearly specified.

1.G Submittals

1. Shop Drawings, Product Data, and Samples
    a. The BMS contractor shall submit a list of all shop drawings with submittals dates within 30 days of contract award.
    b. Submittals shall be in defined packages. Each package shall be complete, shall only reference itself, and previously submitted packages. The packages shall be as approved by the Architect and Engineer.
    c. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
    d. The BMS Contractor shall correct any errors or omissions noted in the first review.
    e. At a minimum, submit the following:
        - BMS network architecture diagrams including all nodes and interconnections
        - Systems schematics, sequences, and flow diagrams
        - Points schedule for each point in the BMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address
        - Samples of Graphic Display screen types and associated menus
        - Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features
        - Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type
        - Room Schedule including a separate line for each Fan Coil box and/or terminal unit indicating location and address
        - Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type
        - Details of all BMS interfaces and connections to the work of other trades
        - Product data sheets or marked catalog pages including part number, photo and description for all products including software
2. Existing Systems Inventory
    a. Where applicable, provide a complete and current BMS site inventory for all existing field and supervisory controllers to be integrated into the new BMS including manufacturer, model number, firmware version, available updates, battery condition, integrations, controlled equipment, and point counts.
    b. Site inventory shall be provided on a separate, new USB compatible flash drive.

1.H Record Documentation

1. Operation and Maintenance Manuals.
    a. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media or USB Flash Drive, and include the following for the BMS provided:
        - Table of contents
        - As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
        - Manufacturer’s product data sheets or catalog pages for all products including software
        - System Operator’s manuals
        - Archive copy of all site-specific databases and sequences
        - BMS network diagrams
        - Interfaces to all third party products and work by other trades
    b. The Operation and Maintenance Manual shall be self-contained, and include all necessary software required to access the product data sheets. Include a logically organized table of contents. Viewer software shall provide the ability to display, zoom, print, and search all documents.
2. On-Line documentation: After completion of all tests and adjustments the contractor shall provide a copy of all as-built information and product data to be installed on a customer designated computer workstation or server.

1.I Warranty

1. Standard Material and Labor Warranty:
    a. Provide a one-year labor and material warranty on the BMS.
    b. If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BMS Contractor at the cost of the BMS Contractor.
    c. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BMS Contractor’s normal business hours.

Part 2 – Products

2.A General Description

1. The BMS shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a wide variety of third party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.
2. The BMS shall consist of the following:

a. Network Engine(s)
b. Equipment Controller(s)
c. Input/Output Module(s)
d. Local Display Device(s)
e. Portable Operator's Terminal(s)
f. Distributed User Interface(s)
g. Network processing, data storage and communications equipment
h. Other components required for a complete and working BMS

3. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.
4. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
    a. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
    b. The System shall maintain all settings and overrides through a system reboot.
5. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
6. The System shall comply with the following International Code Council (ICC) Codes:
    a. Building Officials and code Administrators International (BOMA) model code
    b. International Conference of Building Officials (ICBO) model code
    c. Southern Building Code Congress International (SBCCI) regulations
7. Acceptable Manufacturers
    a. Johnson Controls

2.B BMS System Architecture

1. Automation Network
    a. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard “off the shelf” products available through normal PC vendor channels.
    b. The BMS shall network multiple user interface clients, application and data servers, network engines, system controllers and application-specific controllers including but not limited to:
        i. Network Engines
        ii. Network Control Engines
        iii. Equipment Controllers
        iv. VAV Box Controllers

v. Third Party BACnet controllers and peripheral devices with compatibility listed by BACnet International

vi. Application and Data Server

c. All BMS devices on the automation network shall be capable of operating at a minimum communication speed of 100 Mbps, with full peer-to-peer network communication.

d. Network Security – To protect the BMS from unauthorized users and computer hackers the Automation Network shall support HTTPS with TLS 1.2 between components, including the Application and Data Server(s), Network Engines, Mobile User Interface and Site Management Portal. Self-signed certificates are installed on supported products, with the option of configuring trusted certificates. Computing devices supplied by the BMS vendor will automatically shut down unused ports to deter unauthorized access.

e. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.

2. Control Network

a. Network Engines shall provide supervisory control over the control network and shall selectively support the following communication protocols:

i. BACnet Standard Master-Slave/Token-Passing (MS/TP) Bus Protocol ASHRAE SSPC-135:

a) The Network Engines shall be BTL listed/certified.

b) The Network Engines shall be tested and certified as a BACnet Building Controller (B-BC) profile.

ii. LonWorks enabled devices using the Free Topology Transceiver (FTT-10a)

iii. The Johnson Controls N2 Field Bus

iv. Modbus® TCP and RTU

b. Control networks shall provide either “Peer-to-Peer”, Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.

c. Control network shall support digital controllers as indicated in plans and specifications.

d. Default control network communication protocol for this project shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.

e. A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.

f. The PICS shall be submitted 10 days prior to bidding.

3. Integration

a. Hardwired

i. Analog and digital signal values shall be passed from one system to another via hardwired connections.

ii. There will be one separate physical point on each system for each point to be integrated between the systems.

b. Direct Protocol (Integrator Panel)

i. The BMS system shall include appropriate hardware equipment and software to allow bi-directional data communications between the BMS system and third party manufacturers' control panels. The BMS shall have the ability to receive, react to, and return information from multiple building systems, including but not limited to the chillers, boilers, variable frequency drives, power monitoring system, and medical gas.

ii. All data required by the application shall be mapped into the Network Engine's database, and shall be transparent to the operator.

iii. Point inputs and outputs from the third party controllers shall have real-time interoperability with BMS software features such as: Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data and Trend Analysis, Totalization, and LAN Communications.

c. BACnet Protocol Integration – BACnet

i. The neutral protocol used between systems will be BACnet IP and comply with the ASHRAE BACnet standard 135.

ii. A complete Protocol Implementation Conformance Statement (PICS) shall be provided for all BACnet system devices.

iii. The ability to command, share point object data, change of state (COS) data and schedules between the host and BACnet systems shall be provided.

2.C User Interface

1. Dedicated Web Based User Interface

a. BMS Contractor shall integrate with existing personal computer for command entry, information management, network alarm management, and database management functions. Real-time control functions, including scheduling, history collection and alarming, shall be resident in the BMS Network Engines and Data Server(s) to facilitate greater fault tolerance and reliability.

b. Navigation Trees

i. A dedicated location based navigation tree shall be provided as part of the user interface in order to navigate to specific places within the facility on a hierarchical basis (typ. Facility, Building, Wing, Floor, Room.)

ii. The location-based tree shall use place names familiar to the operator without training or familiarization regarding special codes and conventions utilized in the generation of the BMS.

iii. Clicking or tapping on a location name in the tree shall display the home page associated with the space and simultaneously expand the tree to display the next level of spaces below the one selected.

iv. It shall be possible for qualified users to view a navigation tree of devices connected to the BMS network in order to enable troubleshooting of equipment and communications. Clicking or tapping on the Network Icon at the top of the

Navigation Tree will access this alternate view. Users without the necessary access rights shall not see the Network Icon.

v. A click or tap on a device in the network tree shall display a dashboard for that device including information regarding related equipment and access to a separate focus view of commandable points associated with the piece of hardware. A click or tap on such a point shall display a control dialogue box allowing the user to modify or command that point as indicated. The dialog box shall contain an annotation box for describing why the action was taken or special circumstances that apply.

vi. Specific hardware and software types in the Network tree shall also include access to one or more the following views in their dashboard depending on hardware type or network element (e.g. MS/TP trunk):

- Summary View
- Diagnostic View
- Network View
- Trend View

vii. It shall be possible to hide the Network Tree and return to the Spaces Tree at any time by clicking on the Spaces Icon above the tree.

viii. It shall be possible to restrict user access to any space in the Spaces Tree and thereby prevent manipulation of equipment associated with the space.

c. Dashboard Displays

i. The user interface shall provide the ability to view equipment visualizations, floor plans, and/or other graphics on mobile or desktop client devices in a browser environment, without the need for additional plugins or software. Graphics shall be accessible via a space (for floorplans, campus maps, etc.) or equipment dashboard.

ii. Standard dashboards shall be configured for each defined space including one of the following predefined or custom elements:

- Equipment Serving Space
- Potential Problem Areas
- Equipment Summary
- Graphic Display (if specified)
- Schedule

iii. Standard dashboards shall be configured for each system or device (typ. mechanical or electrical equipment) including the following predefined or custom elements:

- Trend
- Equipment Activity Summary
- Equipment Relationships Summary
- Equipment Data
- Graphic Display (if specified)

- Schedule

iv. Users with appropriate permissions shall have access to a Dashboards Manager that can change the display order of Summaries and Data elements, add or remove elements and apply custom dashboards layouts to equipment and space by type.

v. Dashboard Manager shall apply dashboards to spaces or equipment based on the viewing platform (Desktop/Tablet or Phone) in order to tailor the user experience to the needs of the specific user base.

vi. Default dashboard displays by space and equipment type shall be created per the guidelines in this specification or by mutual agreement with the owner's representative.

d. Alarm Management

i. The user interface shall provide a single display of all potential issues in a facility including items currently in alarm, warning, override, out-of-service and offline.

ii. The user interface shall provide notification of new alarms, visually and audibly.

iii. The user interface shall provide the ability to view a summary of alarms, including a chart of the number of alarms in each of the defined alarm priority ranges. The priority ranges should be filterable.

iv. The user interface shall provide the capability to view multiple occurrences of the same alarm, ultimately providing the ability to acknowledge or discard all occurrences of the alarm in a single action.

v. The user interface shall provide the capability to view, and filter on, all alarms present in a well-defined mechanical system using the equipment serving equipment relationships.

vi. The user interface shall provide the capability to acknowledge and discard all occurrences of at least 1000 alarms in one operation.

vii. The user interface shall provide the user with the understanding of what physical space is being affected when an alarm occurs. The user interface shall provide the ability to filter alarms by physical space affected when the alarm occurred.

viii. The user interface shall provide the capability to monitor alarms 24/7 without requiring an active login to the system, accessible via segregated web page. The user interface shall provide the capability to enabled or disable the 24/7 alarm monitor mode if desired.

ix. The user interface shall provide the capability to annotate alarms using a pre-defined selection list or by providing custom text.

x. The user interface shall provide the capability to filter down alarm list and bookmark the filtered list, allowing automatic filtering to be applied when the bookmark is accessed.

xi. It shall be possible to export a .csv or .pdf copy of the currently displayed alarm list.

xii. If an alarm is not acknowledged or discarded by recipients within a user-selected time, the alarm shall be sent to an additional set of recipients.

e. Send Announcement

i. Administrative users should have the ability to alert staff of planned outages in advance. The communication avenues should include:

- Email
- A message shown on the login screen
- A banner shown to logged in users

f. Equipment Activity Summary

i. The user interface shall provide a filterable, single display, of all activity related to a specific piece of equipment including user changes, discarded user changes, pending alarms, discarded alarms, and acknowledged alarms for at least one year of historical data.

ii. Items shall be listed in timed order with the latest activity at the top of the list.

iii. Filters shall allow only specific activities for specific data points occurring within a specific time and date window to be displayed.

iv. It shall be possible to export a .csv copy of the currently displayed summary by clicking or tapping on the export icon.

v. It shall be possible to create a custom trend graph containing the data shown in the currently displayed summary by tapping or clicking on the trend icon in the header bar and selecting the specific points to trend in the resulting selection panel.

vi. Clicking on the information icon in front of any displayed activity listed in the summary shall expand the display to include the name of the user, server time, value prior to the activity, the ability to annotate the activity and a user selectable icon for displaying a trend graph of the point.

g. Equipment Relationships Summary

i. The user interface shall provide a summary of all equipment and spaces related to the operation of the system or device currently selected for viewing.

ii. The user interface shall include the capability to navigate to the home page of any related piece of equipment or space with a single click or tap on the desired element.

h. Equipment Data Summary

i. The user interface shall provide a summary of all data pertaining to a particular piece of mechanical or electrical equipment in a tabular format. Clicking or tapping on any value in the summary shall display a related command panel allowing the user to command, override, or change service condition of the point selected and to annotate such actions for future reference.

ii. It shall be possible to export a .pdf copy of the report with a single click on the associated export icon.

i. Equipment Serving Space Summary

i. The user interface shall provide a summary of all mechanical and electrical equipment as defined in the points list that serves a selected space from the navigation tree.

ii. The summary shall be capable of including a subset of the viewable points for each system representing the key elements of interest to operators without subjecting them to long lists of points irrelevant to basic operation.

iii. Clicking or tapping on any item in the summary shall navigate to the item's assigned home page in the user interface.

iv. It shall be possible to view a custom trend of information contained in the summary with a single click of the trend icon residing in the title header.

v. It shall be possible to display specific systems and points by filtering equipment types desired.

vi. Because the data is intended to be a snapshot of the current conditions in the space it shall not dynamically update but a click or tap on the update icon at any time performs that function.

j. Potential Problem Areas

i. The user interface shall provide a summary of all points in the system related to the space that are not operating correctly (e.g. alarm, off normal or not communicating correctly) in order to provide the operator with a quick update on current conditions.

ii. The information shall include:

- Point status (via color)
- Point name
- Value of the point when the summary was taken
- Equipment that contains the offending point
- Space that is served by that equipment

iii. Data points in the summary may be filtered by one or more types of off-normal condition (e.g. above setpoint, offline and overridden).

iv. The summary may be exported in .csv format for inclusion in spreadsheets or other documents.

k. Equipment Summary

i. The user interface shall provide a summary that allows the user to compare all similar equipment that serves the space as well as downstream (child) spaces in order to evaluate conditions quickly and determine patterns for troubleshooting purposes.

ii. Each unique equipment type shall be selectable and display a representative set of values along with the space(s) being served by the device. Equipment types can be selected from a dropdown menu in the summary.

iii. Clicking or tapping on a selected device in the summary shall navigate to the home page for that piece of equipment while clicking or tapping a data point shall display the command panel for that point.

iv. It shall be possible to export a .pdf copy of the currently displayed summary by clicking or tapping on the export icon.

v. It shall be possible to create a custom trend graph containing the data shown in the currently displayed summary by clicking on the trend icon in the header bar and selecting the specific points to trend in the resulting selection panel.

l. User Defined Summaries

i. Provide the capability to view, command, and modify large quantities of similar data in summaries without the use of a secondary application (e.g. a spreadsheet). These summaries shall be generated automatically or user defined. User defined summaries shall allow up to seven user defined columns describing attributes to be displayed including custom column labels with up to 100 rows per summary.

m. Trend

i. The user interface shall provide the capability to view historical trend data from multiple pieces of equipment in both bar and line formats.

ii. The user shall have the ability to navigate to a selection list of frequently viewed trends.

iii. Trend graphs shall have to ability to be smartly auto-generated based on equipment and space relationships.

iv. The user shall have the ability to view up to 3 graphs in a single screen and select which data points to plot on each to help with readability.

v. Each graph shall include a dedicated selection icon to export a copy of the graphic and data in .pdf format or the data only as a .csv file.

vi. Trend graphs shall allow the plotting of non-trended point's default values.

vii. The user shall have the ability to add any trended to point a custom trend graph.

viii. The user shall have the ability to save trend graphs for reference later.

ix. The user shall be able to specify the duration of time and aggregation period for each trend line.

x. The user shall have the ability to decide whether to show raw or aggregate trend data.

n. Operator Access

i. The user interface shall provide the ability to segment access to building data based on the space(s) or location(s) the user is physically located in and/or manages. The user interface shall provide the capability to assign "inherited" space permissions and the ability to assign user's space based access in bulk.

ii. The user interface shall provide the ability to segment access to building data based on the space(s) or location(s) the user is physically located in and/or manages. The user interface shall provide the capability to assign "inherited" space permissions and the ability to assign user's space based access in bulk.

o. Graphics

i. The user interface shall display an equipment visualization or graphic within the context of its associated space (building, floor, room, etc.) or equipment dashboard.

ii. Graphics shall include the ability to define individual information layers for operator selection in order to clarify systems status and simplify operation on mobile devices. Where desired a master layer may be defined to include important information about the facility on all graphic screens.

iii. Graphics shall support the use of photo-realistic symbols as well as color change and animation to match the status of the related system control point.

iv. It shall be possible to export a time stamped .pdf file of the graphic being viewed in order to communicate the current conditions in the space or the equipment being viewed and to provide a historic record.

v. An integral graphic manager shall be provided including the following features and capabilities:

- Creation and modification of graphics from any HTML5 capable browser without the need for additional plug-ins or software packages.
- Access to a full suite of pre-defined templates for air and water sourced HVAC applications as well as the ability to add custom templates as created for other use. Pre-aliased graphic templates may be defined and saved for repetitive representations of common mechanical and electrical equipment.
- A full suite of pre-defined three dimensional symbols for mechanical and electrical systems as well as all line, text and shape tools required for integration into a graphic with zoom and pan capabilities on multiple platforms and in multiple browsers.
- The ability to search and replace items in multiple graphics with a single command.
- The ability to import and insert photos and images into the graphic.
- The ability of the graphics manager to create and edit graphics including the ability to bind graphic elements to the values and conditions of system points in both an on-line and off-line mode.
- The ability to create and import custom SVG symbols that can be selectable from the graphical palette and rendered at runtime.

vi. As required, the BMS Contractor shall provide software licenses in the name of the owner for programming, configuration and graphics building tools to allow designated representatives to make changes, modifications or additions to the system. While future updates or revisions may require an update fee, the owner shall incur no additional cost if they choose not to update. Systems that require any annual or time-limited licensing fees shall not be permitted.

p. Scheduling

i. The user interface shall provide the capability to display, in a singular view, all of the effective schedules in the context of the space (building/floor/room, etc.) or equipment that the schedule effects. The software should have the ability to display an effective schedule, for the present, or a future date.

ii. The user interface shall provide a report of all schedules affecting a space or equipment. The report shall provide the user details of events that comprise the weekly schedule and exception schedule(s). The report shall provide a means of

viewing individual breakout scheduling elements for Weekly Schedule, Exceptions and Default Commands.

iii. The user interface shall provide the capability to efficiently change or modify schedules in mass quantities. This includes the capability to add, in bulk, exceptions to schedules, in addition to assigning, in bulk, weekly schedules.

q. Command and Control

i. It shall be possible to command system analog and binary points via a dropdown menu accessed by clicking or tapping on the value shown in any equipment summary or graphic display and completing the task in the resultant menu including an optional annotation.

ii. Commanding multiple points shall be possible on displays where multiple like system elements can be chosen.

iii. The user interface shall support users adding notes on their commands.

iv. The user interface shall support a choice of either permanent or temporary commands.

r. Cyber Health Dashboard

i. The Cyber Health Dashboard shall provide a centralized view of potential cybersecurity related issues or system issues, grouped into critical issues, potential risks, and informational items.

i. The Cyber Health Dashboard shall identify user account information, including:

a. Total number of users

b. Dormant users

c. Active users

d. Locked users

e. Temporary users

f. Disabled users

g. Users with Administrator role

h. Policy related information

ii. The Cyber Health Dashboard shall indicate out-of-date software.

iii. The Cyber Health Dashboard shall identify when security certificates are set to expire.

iv. The Cyber Healthy Dashboard shall provide insight into user activity such as number of successful logins, unsuccessful logins, and locked out accounts.

s. Involvement

i. The user interface shall provide in a single screen, a way to visualize all interactions (I.e. - commands, writes, references) with a single object.

ii. The interface shall provide the ability to filter out any interactions (i.e. commands, writes, references) that are not pertinent.

iii. The user interface shall allow seamless navigation between one object's Involvement view to another object's.

t. System-level Activity

i. The user interface shall provide a timeline view of all audits that occur in the system, including:

a. Logins attempts with user specified

b. Add, delete, modification of objects

c. Commands

u. Search

i. Typing a text string in the Search box shall display a list of all occurrences of that string in the mobile user interface. When a string is represented in the description of a space or network element, selecting it shall display its default dashboard.

ii. Clicking or tapping on the Advanced Search Icon shall display the Advanced Search dialog box permitting the following:

- Search by Space and Equipment, Equipment Definition or Network Reference
- Filter the search by wildcard name or object type
- Multi-selection of objects for commanding or the creation of reports including Trend, Alarm, Audit and Activity for a specific period of time

v. Software Updates

i. Users shall be notified when new software becomes available for download.

ii. Users shall be given brief information on what's to be expected in the update.

w. Offline Operation

i. The mobile user interface shall have the ability to operate in an offline mode in order to create or edit graphics and dashboard elements.

ii. Content created offline shall be available to all authorized users for inclusion of an operating user interface later.

x. Fault Detection

i. The building system fault engine shall run periodically against a minimum of seven days of historical data.

ii. The building system fault engine shall be capable of executing rules based faults.

iii. The fault engine shall include fault suppression capability which manages the suppression of faults based on the building system relationships and fault types.

iv. The BMS shall provide a Fault Viewer capable of displaying faults identified by the fault engine.

v. The Fault Viewer shall be capable of showing a list of building system faults in order of how severe the fault is.

vi. The Fault Viewer shall display a textual and color indication of the Fault Category (Critical, High, Medium, or Low).

vii. The Fault Viewer shall provide a visual indication and count of faults that any given fault list item has suppressed.

viii. The Fault Viewer shall minimize the list of faults by only providing a single fault list item per building system (displaying the worst fault).

ix. The Fault Viewer shall display a count and provide a list of faults for any given building system that has more than one fault.

x. The Fault Viewer shall provide links to more information on the building system and the space(s) which it servers.

xi. The Fault Viewer shall provide a method for an end user to:

- Disable a fault rule for a single building system
- Disable a fault rule for all building systems
- Disable all fault rules for a single building system

xii. The Fault Viewer shall provide a Filtering mechanism which shall allow filtering based on building system type and/or Fault Category.

xiii. The Fault View shall be capable of exporting the Fault list to a comma separated value file.

xiv. The fault engine shall be capable of running fault rules with or without historical trends being defined.

xv. The BMS shall provide a Fault Manager.

xvi. The Fault Manager shall provide a list of Fault Rules.

xvii. The Fault Manager shall provide a method for an end user to enable or disable any single fault rule and/or all fault rules.

xviii. The Fault Manager shall provide a Name and Description for each Fault Rule describing what criteria need to be met in order for a fault to be generated.

xix. The Fault Manager shall provide the names and values of Attributes (or thresholds) for which any fault rule is being run against.

xx. The Fault Manager shall display any building systems which have been disabled from the fault rule to run against.

xxi. The Fault Manager shall provide a method for an end user to enable a building system to run a fault rule which it previously was disabled from running.

xxii. The Fault Manager shall provide a list of shared Attributes that the fault rules run against.

xxiii. The Fault Manager shall have a method for an end user to save changes to a file and import a previously saved file.

y. Fault Triage

i. The Fault Viewer shall be capable of showing a list of building system faults in a ranked order derived from fault severity, fault duration, and fault occurrence.

ii. The Fault Viewer shall provide a visual indication of:

- fault occurrences and count

- fault duration
- status of progress against resolving any given fault
- a fault that has reoccurred

iii. The Fault Viewer shall provide a link to a Fault Diagnostic and Resolution Viewer.

iv. The Fault Diagnostic and Resolution Viewer shall include a Fault Details section.

v. The Fault Details shall contain:

- The name of the building system which the fault occurred against
- A link to more information on the building system
- The name of the space(s) affected by the fault
- A link to more information on the space(s)
- The total duration for which the fault has occurred
- The number of occurrences

vi. The Fault Diagnostic and Resolution Viewer shall include a Possible Root Cause and Resolution Manger.

vii. The Possible Root Cause and Resolution Manager shall:

- Provide a list of Possible Root Cause Groups
- Provide a likeliness percentage of how frequently items within a Possible Root Cause Group has been the root cause of a fault
- Provide a list of individual root causes for each Possible Root Cause Group
- Provide a recommendation to resolve any give individual root cause
- Provide a method for an end user to keep track of his/her progress with troubleshooting/resolving the fault

viii. The Fault Diagnostic and Resolution Viewer shall include the Name and the criteria for the Fault being viewed.

ix. The Fault Diagnostic Resolution Viewer shall include Fault Charting.

x. Fault Charting shall provide a method for the end user to navigate multiple charts relating to all of the fault occurrences.

xi. Fault Charting shall display the Date / Time of the current fault being displayed.

xii. Fault Charting shall display the duration of time for the current fault being displayed.

xiii. Fault Charting, at a minimum, shall consist of three stacked charts which share a time based x axis.

xiv. The Fault Charting top chart shall display a process variable and setpoint(s) for faults which are control based.

xv. The Fault Charting middle chart shall display analog outputs.

xvi. The Fault Charting bottom chart shall display binary outputs and enumerations.

xvii. The Fault Charting shall include points required for fault rule execution.

xviii. The Fault Charting shall include visual indication of the duration of the fault within all charts.

xix. The Fault Charting shall include additional points not required, but related to any given fault.

xx. The Fault Charting shall include a tool tip to show all points values at any given time.

xxi. The Fault Diagnostic and Resolution Viewer shall include an Activity List.

xxii. The Activity List shall provide an audit of fault occurrences.

xxiii. The Activity List shall provide an audit of users' progress within the Possible Root Cause and Resolution Manager.

xxiv. The Activity List shall provide a method for an end user to add a note to the Activity List.

xxv. Activity List items shall provide an action description.

xxvi. Activity List items shall provide the user which performed the action.

xxvii. Activity List items shall provide the Date/Time of when the action was performed.

2.D Network Engines

1. General

a. The Network Engine shall be a fully user-programmable, supervisory controller. The Network Engine(s) shall monitor the network of distributed equipment controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Engine(s).

b. Automation network – The Network Engine(s) shall reside on the automation network and shall support a subnet of system controllers.

c. User Interface – Each Network Engine shall have the ability to deliver a web-based User Interface using the Site Management Portal functionality previously described. All computers connected physically or virtually to the automation network shall have access to the web-based user interface.

i. The web-based user interface software shall be embedded in the Network Engine(s). Systems that require a local copy of the system database on the user's device are not acceptable.

ii. The Network Engine(s) shall support a minimum of two (2) concurrent users.

iii. The web-based user interface shall have the capability to access all system data through a single Network Engine.

iv. Remote users connected to the network using a Virtual Private Network (VPN) shall also have total system access through one Network Engine.

v. Systems that require the user to address more than one Network Engine to access all system information are not acceptable.

vi. The Network Engine shall have the capability of serving web-based user interface graphics. The graphics capability shall be embedded in the Network Engine.

vii. Systems that only support user interface graphics from a central database or require the graphics to reside on the user's device are not acceptable.

viii. The web-based user interface shall support the following functions using a supported web browser:

- Configuration
- Commissioning
- Data Archiving
- Monitoring
- Commanding
- System Diagnostics

ix. Systems that require workstation software or modified web browsers for system queries are not acceptable.

d. Processor – The Network Engine(s) shall be microprocessor-based with a minimum word size of 32 bits. The Network Engine(s) shall be a multi-tasking, multi-user, and real-time digital control processor. Standard operating systems shall be employed. Network Engine(s) size and capability shall be sufficient to fully meet the requirements of this Specification.

e. Memory – Each Network Engine shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.

f. Secure Boot – The Network Engine(s) shall prevent malicious or unauthorized software applications from loading during the system startup process.

g. User Authentication – The Network Engine(s) shall support local user authentication.

h. Password Security – Access to the Network Engines' embedded user interface shall require a password of 8 to 50 characters including a minimum of one lower case letter, one upper case letter, one number, and one special character. An alarm shall be generated after three unsuccessful attempts within 15 minutes, and the user shall be denied access until permission is renewed by a system administrator.

i. Network Security – Communication between the Network Engine and other system networked devices including additional Network Engines, Application and Data Servers, Open Data Servers (BACnet listed OWS), and user interface clients shall be encrypted and support HTTPS with Transport Level Security (TLS) Version 1.2. Self-signed certificates are to be provided with the option of configuring trusted certificates.

j. Hardware Real Time Clock – The Network Engine(s) shall include an integrated, hardware-based, real-time clock, with a supercapacitor to maintain time for a minimum of 72 hours during a power loss. Controllers using a battery to maintain time during a power loss shall not be acceptable.

k. Diagnostics – The Network Engine(s) shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Engine(s) shall provide both local and remote annunciation of any detected component failures or repeated failures to establish communication.

l. Power Failure – In the event of the loss of normal power, the Network Engine(s) shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.

   i. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.

   ii. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.

m. Certification – The Network Engine(s) shall meet and be listed to the UL 916 Standard for Energy Management Equipment and be FCC Compliant to CFR47, Part 15, Subpart B, Class A.

n. Device Integration – The Network Engine(s) shall support integrating networked devices using the following communication protocols on the device/controller network:

   i. The Network Engine(s) shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135 on the controller network.

      - The Network Engine(s) shall support Remote Field Bus integration via a BACnet IP to MS/TP router.
      - The Network Engine(s) shall be tested and BTL listed/certified as a BACnet Building Controller (B-BC).
      - A BACnet Protocol Implementation Conformance Statement shall be provided for the Network Engine(s).
      - The Protocol Implementation Conformance Statement shall be submitted 10 days prior to bidding.

   ii. The Network Engine shall support LonWorks enabled devices using a whitelisted USB-to-LonWorks FTT10 Free Topology Transceiver adapter.

      - All LonWorks controls devices shall be LonMark® certified.

   iii. The Network Engine(s) shall support Johnson Controls N2 or third party N2 Open devices.

   iv. The Network Engine(s) shall optionally support integration of networked devices using the following networking protocols:

      - MODBUS RTU
      - MODBUS TCP
      - KNX - KNX is an open communication standard (EN 50090, ISO/IEC 14543) that many European manufacturers have applied to lighting controls, blinds and shutters, HVAC controls, security systems, energy management, audio, video, displays, and remote controls.
      - M-Bus - M-Bus (Meter Bus) is a European standard (EN 1434-3) that applies primarily to energy and heat meters.
      - C-CURE 9000 Access Control System
      - victor Video Management System

- OPC UA

o. The Network Engine(s) shall include the following multi-color, flashing LEDs to indicate important operating conditions and status:

i. Heartbeat – to indicate each of the following states: operational (normal), powered but not operational, starting up, shutting down, or no power applied

ii. Fault – to indicate if fault conditions have been detected

iii. Ethernet Activity – to indicate if Ethernet Traffic is occurring or not occurring.

iv. Ethernet Link Speed – to indicate the speed of Ethernet Link (10, 100, or 1000 Mbps)

v. Site Director – to indicate if the Network Engine has been designated as the Site Director

vi. BACnet/IP – to indicate if the Network Engine is transmitting BACnet messages over BACnet/IP to other devices, including other Network Engines

vii. USB -1 – to indicate if a supported device is connected, no device is connected, or an unsupported device is connected on USB port 1

viii. USB-1 – to indicate if a supported device is connected, no device is connected, or an unsupported device is connected on USB port 2

ix. FC BUS-# – to indicate if communication is occurring on FC Bus port # (1 or 2)

x. FC EOL-# – to indicate if the end-of-line termination switch # (1 or 2) is on or off

2. Network Engine – Standard

a. The Network Engine shall support up to 50 supervised devices across all supported integrations.

b. Communications Ports – The Network Engine(s) shall provide the following ports for connecting networkable devices:

i. Two (2) USB ports

ii. One (1) RS-485 ports

iii. One (1) Ethernet port

c. Provide Johnson Controls SNE1050 or approved equal as indicated on plans.

3. Network Engine – Large

a. The Network Engine shall support up to 100 supervised devices across all supported integrations.

b. Communication Ports – The Network Engine(s) shall provide the following ports for connecting networkable devices:

i. Two (2) USB ports

ii. One (1) RS-485 port

iii. One (1) Ethernet port

c. Provide Johnson Controls SNE1100 or approved equal as indicated on plans.

4. Network Engine – Large, Dual Trunk

a. The Network Engine shall support up to 200 supervised devices across all supported integrations.

b. Communications Ports – The Network Engine(s) shall provide the following ports for connecting networkable devices

   i. Two (2) USB ports

   ii. Two (2) RS-485 ports

   iii. One (1) Ethernet port

c. Provide Johnson Controls SNE2200 or approved equal as indicated on plans.

2.E Network Control Engines

1. General

   a. The Network Control Engine shall be a fully user-programmable, supervisory controller. The Network Control Engine shall monitor the network of equipment controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Engines.

   b. The Network Control Engine shall also be a fully user-programmable, equipment controller that includes a minimum of 28 I/O points.

   c. Automation Network – The Network Control Engine(s) shall reside on the automation network and shall support a subnet system controllers.

   d. User Interface – Each Network Control Engine shall have the ability to deliver a web-based User Interface using the Site Management Portal functionality previously described. All computers connected physically or virtually to the automation network shall have access to the web-based user interface.

      i. The web-based user interface software shall be embedded in the Network Control Engine(s). Systems that require a local copy of the system database on the user's device are not acceptable.

      ii. The Network Control Engine shall support a minimum of two (2) concurrent users.

      iii. The web-based user interface shall have the capability to access all system data through a single Network Control Engine.

      iv. Remote users connected to the network through a Virtual Private Network (VPN) shall also have total system access through one Network Control Engine.

      v. Systems that require the user to address more than one Network Control Engine to access all system information are not acceptable.

      vi. The Network Control Engine shall have the capability of serving web-based user interface graphics. The graphics capability shall be embedded in the Network Control Engine.

      vii. Systems that only support user interface graphics from a central database or require the graphics to reside on the user's device are not acceptable.

      viii. The web-based user interface shall support the following functions using a supported web browser:

         - Configuration

- Commissioning
- Data Archiving
- Monitoring
- Commanding
- System Diagnostics

ix. Systems that require workstation software or modified web browsers are not acceptable.

e. Processor – The Network Control Engine(s) shall be microprocessor-based with a minimum word size of 32 bits. The Network Control Engine shall be a multi-tasking, multi-user, and real-time digital control process. Standard operating systems shall be employed. Network Control Engine(s) size and capability shall be sufficient to fully meet the requirements of this Specification.

f. Memory – Each Network Control Engine shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.

g. Secure Boot – The Network Control Engine shall prevent malicious or unauthorized software applications from loading during the system startup process.

h. User Authentication – The Network Control Engine shall support local user authentication.

i. Password Security – Access to the Network Control Engines' embedded user interface shall require a password of 8 to 50 characters including a minimum of one lower case letter, one upper case letter, one number, and one special character. An alarm shall be generated after three unsuccessful attempts within 15 minutes and the user shall be denied access until permission is renewed by a system administrator.

j. Network Security – Communication between the Network Control Engine and other system networked devices including additional Network Engines, Application and Data Servers, Open Data Servers (BACnet listed OWS), and user interface clients shall be encrypted and support HTTPS with Transport Level Security (TLS) Version 1.2. Self-signed certificates are to be provided with the option of configuring trusted certificates.

k. Hardware Real Time Clock – The Network Control Engine shall include an integrated, hardware-based, real-time clock, with a supercapacitor to maintain time for a minimum of 72 hours during a power loss. Controllers using a battery to maintain time during a power loss shall not be acceptable.

l. Diagnostics – The Network Control Engine(s) shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Control Engine(s) shall provide both local and remote annunciation of any detected component failures or repeated failures to establish communication.

m. Power Failure – In the event of the loss of normal power, the Network Control Engine(s) shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.

i. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.

ii. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.

n. Certification – The Network Control Engine(s) shall meet and be listed to the UL 916 Standard for Energy Management Equipment and be FCC Compliant to CFR47, Part 15, Subpart B, Class A.

o. Device Integration – The Network Control Engine(s) shall support integrating and supervising networked devices using the following communication protocols on the device/controller network:

i. The Network Control Engine(s) shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135 on the controller network.

- The Network Control Engine(s) shall support Remote Field Bus integration via a BACnet IP to MS/TP router.
- The Network Control Engine(s) shall be tested and BTL listed/certified as a BACnet Building Controller (B-BC).
- A BACnet Protocol Implementation Conformance Statement shall be provided for the Network Engine(s).
- The Protocol Implementation Conformance Statement shall be submitted 10 days prior to bidding.

ii. The Network Control Engine(s) shall support LonWorks enabled devices using a whitelisted USB-to-LonWorks FTT10 Free Topology Transceiver adapter.

- All LonWorks controls devices shall be LonMark® certified.

iii. The Network Control Engine(s) shall support Johnson Controls N2 or third party N2 Open devices.

iv. The Network Engine(s) shall optionally support integration of networked devices using the following networking protocols:

- MODBUS RTU
- MODBUS TCP
- KNX – KNC is an open communication standard (EN 50090, ISO/IEC 14543) that many European manufacturers have applied to lighting controls, blinds and shutters, HVAC controls, security systems, energy management, audio, video, displays, and remote controls.
- M-Bus – M-Bus (Meter Bus) is a European standard (EN 1434-3) that applies primarily to energy and heat meters.
- C-CURE 9000 Access Control System
- victor Video Management System
- OPC UA

p. The Network Control Engine shall employ a finite state programming to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.

q. The Network Control Engine shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only, shall not be acceptable.

r. The Network Control Engine shall support the following types of inputs and outputs:

   i. Universal Inputs – shall be configured to monitor any of the following:

      - Analog Input, Voltage Mode
      - Analog Input, Current Mode
      - Analog Input, Resistive Mode
      - Binary Input, Dry Contact Maintained Mode
      - Binary Input, Pulse Counter Mode

   ii. Binary Inputs – shall be configured to monitor either of the following:

      - Dry Contact Maintained Mode
      - Pulse Counter Mode

   iii. Analog Outputs – shall be configured to output either of the following:

      - Analog Output, Voltage Mode
      - Analog Output, Current Mode

   iv. Binary Outputs – shall output the following:

      - 24 VAC Triac

   v. Configurable Outputs – shall be configured to output either of the following:

      - Analog Output, Voltage Mode
      - Binary Output, 24 VAC Triac Mode

s. The Network Control Engine shall have the ability to monitor and control a network of sensors and actuators over a Sensor Actuator (SA) Bus.

   i. The SA Bus shall be a MS/TP Bus supporting BACnet Standard protocol SSPC-135.

   ii. The SA Bus shall support a minimum of 9 devices.

   iii. The SA Bus shall operate at a maximum distance of 1,200 Ft. between the Network Control Engine and the furthest connected device.

t. The Network Control Engine shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the Field Bus or the SA Bus.

u. The Network Control Engine shall support, but not be limited to, the following applications:

   iv. Central heating plant applications.

   v. Lighting and electrical distribution.

   vi. Built-up air handling units for special applications.

   vii. Power generation and energy monitoring equipment.

viii. Interfaces to security and fire detection systems.

v. The Network Control Engine shall provide removable, labeled, screw terminal blocks for 24 VAC power, communication bus and I/O point field wiring.

w. The Network Control Engine shall include the following multi-color, flashing LEDs to indicate important operating conditions and status:

i. Heartbeat – to indicate each of the following states: operational (normal), powered but not operational, starting up, shutting down, or no power applied

ii. Fault – to indicate if fault conditions have been detected

iii. SA Bus – to indicate if communication is occurring on the SA Bus

iv. FC BUS-1 – to indicate if communication is occurring on FC Bus port 1

v. Ethernet Activity - to indicate if Ethernet Traffic is occurring or not occurring

vi. USB-1|2 – to indicate if a supported device is connected, no device is connected, or an unsupported device is connected on USB port 1 or 2

vii. FC EOL - to indicate if the end-of-line termination switch is on or off

x. Communications Ports – The Network Control Engine(s) shall provide the following ports for connecting networkable devices:

i. Two (2) USB ports

ii. One (1) RS-485 port

iii. Two (2) Ethernet ports

2. Network Control Engine – Standard

a. The Network Control Engine shall support up to 4 supervised devices across all supported integrations.

b. Provide Johnson Controls SNCxxxxx-04x or approved equal as indicated on plans.

3. Network Control Engine – Large

a. The Network Control Engine shall support up to 50 supervised devices across all supported integrations.

b. Provide Johnson Controls SNCxxxxx-0x or approved equal as indicated on plans.

2.F Application and Data Servers

1. Application and Data Server (ADS)

a. The Application and Data Server shall be a software solution designed to manage the collection and presentation of large amounts of trend data, event messages, operator transactions, and system configuration data on the BMS.

b. The Application and Data Server shall act as site director for consolidating BMS information from Network Engines for integrated storage and presentation. The ADS shall not restrict access to the individual Network Engines ensuring optimal BMS accessibility in the event of individual component failure or a loss of communication.

c. The Application and Data Server shall act as a server for the following functionality as described in these specifications:

- Mobile user interface providing user friendly access to system information via site navigation by place or device.
- Site Management Portal functions and applications.
- System Configuration Tool controller configuration and programming.

d. Network Security – Communication between the Network Engines, Application and Data Server, and user interface clients shall be encrypted and support HTTPS with Transport Level Security (TLS) Version 1.2. Self-signed certificates are to be provided with the option of configuring trusted certificates.

e. The Application and Data Server shall be capable of supporting up to 5 simultaneous users via web browser client access.

f. User Authentication – The Application and Data Server shall support Metasys Local, Active Directory LDAP, Active Directory Federated System, and Microsoft Office 365 authentication.

g. Computer shall be configured as specified in the Computing Hardware and Software section of this specification.

h. Provide Johnson Controls MS-ADS, M4-OAS or approved equal.

2. Extended Application and Data Server

a. The Extended Application and Data Server shall manage the collection and presentation of large amounts of trend data, event messages, operator transactions, and system configuration data.

b. The Extended Application and Data Server shall act as site director for consolidating BMS information from large number of Network Engines for integrated storage and presentation of data. The Extended Application and Data Server shall not restrict access to the individual Network Engines ensuring optimal BMS accessibility in the event of individual component failure or communications loss.

c. The Extended Application and Data Server shall act as a server for the following functionality as described in these specifications:

- Mobile user interface providing user friendly access to system information via site navigation by place or device
- Site Management Portal functions and applications
- System Configuration Tool controller configuration and programming

d. Network Security – Communication between the Network Engines, Extended Application and Data Server, and user interface clients shall be encrypted and support HTTPS with Transport Level Security (TLS) Version 1.2. Self-signed certificates are to be provided with the option of configuring trusted certificates.

e. The Extended Application and Data Server shall be capable of supporting up to 25 simultaneous users via Web client access.

f. The Extended Application and Data Server shall support the addition of optional software packages for advanced reporting and essential energy information. Where provided:

i. An Advanced Reporting package shall provide historical and configuration data reporting capabilities in a user interface that is separate from the site management

user interface, allowing authorized users to run reports for immediate review in a web browser including:

- Configuration Setup Report
- System Behavior Report
- Trend Report – including statistical calculations and Mean Kinetic Temperature (MKT)
- Trend Detail Report – including summary data

ii. The Energy Essentials package shall extend reporting capabilities to include prepackaged reports providing a high-level view of normalized energy use across the site:

- Big Picture Energy
- Consumption
- Electrical Energy
- Production
- Simple Energy Cost
- Load Profile
- Equipment Runtime

g. Supported Web Client operating systems:

i. Microsoft Windows 7, 8.1, 10 (Professional, Enterprise, Ultimate, Anniversary.)

ii. Apple OS X 10.8, 10.9, 10.10, 10.11.

h. Supported Web Browsers:

i. Google Chrome

ii. Microsoft Internet Explorer 11

iii. Microsoft Edge

iv. Apple Safari 11 or later

i. User Authentication – The Extended Application and Data Server shall support local, Active Directory, and Microsoft 365 authentication.

j. Computer shall be configured as specified in the Computing Hardware and Software section of this specification.

k. Provide Johnson Controls MS-ADX or approved equal.

2.G DDC Equipment Controllers

1. General Purpose Equipment Controller

a. The General Purpose Equipment Controller (CGM) shall be a fully programmable, digital controller that communicates via the BACnet MS/TP protocol.

i. The CGM shall support BACnet Standard ANSI/ASHRAE 135.

- The CGM shall be BTL listed/certified.
- The CGM shall be tested and certified as a BACnet Advanced Application Controller (B-AAC).

- A BACnet Protocol Implementation Conformance Statement shall be provided for the CGM.
- The Conformance Statement shall be submitted 10 days prior to bidding.

b. The CGM shall employ finite state programming to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.

c. CGM controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.

d. The CGM shall be assembled in a plastic housing with protection class IP20 (IEC529) and flammability rated to UL94-5VB.

e. The CGM shall include an integral real-time clock and support time-based tasks which enables these field controllers to monitor and control:

   i. Schedules

   ii. Calendars

   iii. Alarms

   iv. Trends

f. The CGM can continue time-based monitoring when offline for extended periods of time from a network.

g. The CGM can operate as a stand-alone controller in applications that do not require a networked supervisory device or for network applications where it is preferred to have the scheduling, alarming, and/or trending performed locally in the equipment controllers.

h. The CGM shall include troubleshooting LEDs to indicate the following conditions:

   i. Power—to indicate if the controller is powered or not powered

   ii. Fault – to indicate if the controller is in its default state, has no faults, has a device fault, is in startup or download mode, or has an SA Bus communication issue

   iii. SA Bus – to indicate if SA Bus communication is occurring and normal, is not occurring, or was occurring but has been lost and is waiting to rejoin

   iv. FC Bus – to indicate if FC Bus communication is occurring and normal, is not occurring, or was occurring but has been lost and is waiting to rejoin

   v. EOL – to indicate if the end-of-line termination switch is on or off

i. The CGM shall have the ability to transfer and apply firmware files to all SA Bus devices (XPM, IOM, and NS8000) connected to it.

j. The CGM shall include pluggable and labeled screw terminal blocks for all I/O, FC and SA Bus communication, and power wiring connections.

k. The CGM shall accommodate the direct wiring of analog and binary I/O field points with the following resolution.

   i. Inputs – 24-bit analog-to-digital converter

ii. Outputs – +/- 200 mV accuracy in 0-10 VDC applications

l. The CGM shall support the following types of inputs and outputs supplied in the amounts required for the specified applications:

i. Universal Inputs – shall be configurable to monitor any of the following:

- 0-10 VDC analog input
- 4-20 mA analog input
- 0-600k ohms analog input
- Dry contact binary input

ii. Binary Inputs – shall be configurable to monitor either of the following:

- Dry Contact Maintained Mode
- Pulse Counter Mode

iii. Analog Outputs – shall be configurable to output either of the following:

- 0-10 VDC analog output
- 4-20 mA analog output

iv. Binary Outputs – shall output the following:

- 24 VAC Triac

v. Configurable Outputs – shall be capable of the following:

- 0-10 VDC analog output
- 24 VAC Triac binary output

m. The CGM shall have the ability to reside on a Field Controller Bus (FC Bus).

i. The FC Bus shall be a MS/TP Bus supporting BACnet Standard protocol SSPC-135.

ii. The FC Bus shall support communications between the CGMs and the Network Engine.

iii. The FC Bus shall also support peer-to-peer communications between non-supervisory devices, allowing these devices to communicate system data with each other directly, bypassing the supervisory network engine on the bus.

iv. The FC Bus shall support a minimum of 100 equipment controllers and/or expansion modules in any combination.

v. The FC Bus shall operate at a maximum distance of 15,000 Ft. between the CGM and the furthest connected device.

n. The CGM shall include three (3) decimal rotary dial switches for setting the BACnet MS/TP device address.

o. The CGM shall have the ability to monitor and control a network of sensors and actuators over a SA Bus.

i. The SA Bus shall be a MS/TP Bus supporting BACnet Standard Protocol SSPC-135.

ii. The SA Bus shall support a minimum of 10 devices per trunk.

iii. The SA Bus shall operate at a maximum distance of 1,200 Ft. between the CGM and the furthest connected device.

p. The CGM shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over a MS/TP Bus.

q. The CGM shall support, but not be limited to, the following applications.

iv. Heating central plant applications.

v. Built-up air handling units for special applications.

vi. Terminal & package units.

vii. Special programs as required for systems control.

r. The CGM shall support a Local Controller Display as a remote device communicating over the SA Bus.

i. The Display shall use a BACnet Standard SSPC-135 MS/TP protocol.

ii. The Display shall allow the user to view monitored points without logging into the system.

iii. The Display shall allow the user to view and change setpoints, modes of operation, and parameters.

iv. The Display shall provide password protection with user adjustable password timeout.

v. The Display shall be menu driven with separate paths for:

- Input/Output
- Parameter/Setpoint
- Overrides

vi. The Display shall use easy-to-read English text messages.

vii. The Display shall allow the user to select the points to be shown and in what order.

viii. The Display shall support a back lit LCD with adjustable contrast and brightens and automatic backlight brightening during user interaction.

ix. The display shall be a minimum of 4 lines and a minimum of 20 characters per line.

x. The Display shall have a keypad with no more than 7 keys.

xi. The Display shall be panel mountable.

s. Provide Johnson Controls CGM or approved equal as shown on plans.

2. XPM expansion I/O module (XPM)

a. The XPM provides additional input and output interfaces for use in digital controllers.

b. The XPM shall communicate with controllers over the FC Bus or the SA Bus.

c. The XPM shall support BACnet Standard ANSI/ASHRAE 135.

i. The XPM shall be BTL listed/certified and carry the BTL Label.

ii. The XPM shall be tested and certified as a BACnet Smart Actuator (B-SA).

iii. A BACnet Protocol Implementation Conformance Statement shall be provided for the XPM.

iv. The Conformance Statement shall be submitted 10 days prior to bidding.

d. The XPM shall include pluggable screw terminal blocks for all I/O, SA/FC bus communication, and power wiring connections.

e. The XPM shall include three (3) decimal rotary dial switches for setting the BACnet MS/TP device address.

f. The XPM shall accommodate the direct wiring of analog and binary I/O field points with the following resolution:

i. Inputs – 24-bit analog-to-digital converter

ii. Outputs – +/- 200 mV accuracy in 0-10 VDC applications

g. The XPM shall support the following types of inputs and outputs:

i. Universal Inputs – shall be configured to monitor any of the following:

- 0-10 VDC analog input
- 4-20 mA analog input
- 0-600k ohms analog input
- Dry contact binary input

ii. Binary Inputs – shall be configured to monitor either of the following:

- Dry Contact Maintained Mode
- Pulse Counter Mode

iii. Analog Outputs – shall be configured to output either of the following:

- 0-10 VDC analog output
- 4-20 mA analog output

iv. Binary Outputs – shall output the following:

- 24 VAC Triac

v. Configurable Outputs – shall be capable of the following:

- 0-10 VDC analog output
- 24 VAC Triac binary output

h. The XPM shall include troubleshooting LEDs to indicate the following conditions:

i. Power – to indicate if the device is powered or not powered

ii. Fault – to indicate if the device is in its default state, has no faults, has a device fault, is in startup or download mode, or has an SA Bus communication issue

iii. SA/FC Bus – to indicate if bus communication is occurring and normal, is not occurring, or was occurring but has been lost and is waiting to rejoin

iv. EOL – to indicate if the end of line termination is on or off.

i. Provide Johnson Controls XPM or approved equal as shown on plans.

3. Network Sensors
   a. The Network Sensors (NS) shall have the ability to monitor the following variables as required by the systems sequence of operations:
      i. Zone Temperature
      ii. Zone Humidity
      iii. Zone Setpoint
      iv. Discharge Air Temperature
      v. Zone CO_2
   b. The NS shall transmit the information back to the controller on the SA Bus using BACnet Standard protocol SSPC-135.
   c. The NS shall be BTL listed/certified and carry the BTL Label.
      i. The NS shall be tested and certified as a BACnet Smart Sensors (B-SS).
      ii. A BACnet Protocol Implementation Conformance Statement shall be provided for the NS.
      iii. The Conformance Statement shall be submitted 10 days prior to bidding.
   d. The Network Zone Temperature Sensors shall include the following items:
      i. A backlit LCD to indicate the temperature, humidity and setpoint
      ii. An LED to indicate the status of the Override feature
      iii. A button to toggle the temperature display between Fahrenheit and Celsius
      iv. A button to program the display for temperature or humidity
      v. A button to initiate a timed override command
      vi. Available in either surface mount, wall mount, or flush mount
      vii. Available with either screw terminals or phone jack
   e. The Network Discharge Air Sensors shall include the following:
      i. 4 inch or 8 inch duct insertion probe
      ii. Ten foot pigtail lead
      iii. Dip Switches for programmable address selection
      iv. Ability to provide an averaging temperature from multiple locations
      v. Ability to provide a selectable temperature from multiple locations
   f. The Network CO_2 Zone Sensors shall include the following:
      i. Available in either surface mount or wall mount
      ii. Available with screw terminals or phone jack
      iii. Measurement range of 0-2000 ppm
      iv. Sensing resolution of 1 ppm

v. Sensing accuracy of +/- 2% of the reading plus 40 ppm

g. Provide Johnson Controls NS series or approved equal where indicated on plans.

Part 3 – Performance/Execution

3.A BMS Specific Requirements

1. Graphic Displays
   a. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.
   b. User shall access the various system schematics via a graphical penetration scheme and/or menu selection.
2. Custom Reports:
   a. Provide custom reports as required for this project.
3. Actuation / Control Type
   a. Primary Equipment
      i. Controls shall be provided by equipment manufacturer as specified herein.
      i. All damper and valve actuation shall be electric.
   b. Air Handling Equipment
      i. All air handlers shall be controlled with a HVAC-DDC Controller.
      ii. All damper and valve actuation shall be electric.
   b. Terminal Equipment:
      i. Terminal Units (Fan Coils, IDU's, etc.) shall have electric damper and valve actuation.
      ii. All Terminal Units shall be controlled with HVAC-DDC Controller.

3.B Installation Practices

1. BMS Wiring
   a. All conduit, wiring, accessories and wiring connections required for the installation of the BMS, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 24 Electrical. All wiring shall comply with the requirements of applicable portions of Division 24 and all local and national electric codes, unless specified otherwise in this section.
   b. All BMS wiring materials and installation methods shall comply with BMS manufacturer recommendations.
   c. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.
   d. Class 2 Wiring

i. All Class 2 (24 VAC or less) wiring shall be installed in conduit unless otherwise specified.

ii. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5’ from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.

e. Class 2 signal wiring and 24 VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.

f. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

2. BMS Line Voltage Power Source

a. 120-volt AC circuits used for the BMS shall be taken from panel boards and circuit breakers provided by Division 26.

b. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.

c. DDC terminal unit controllers may use AC power from motor power circuits.

3. BMS Raceway

a. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2”.

b. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.

c. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.

d. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

4. BMS Panel Installation

a. The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer’s recommendations.

b. The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

5. Input Devices

a. All Input devices shall be installed per the manufacturer recommendation.

b. Locate components of the BMS in accessible local control panels wherever possible.

6. HVAC Input Devices – General

a. All Input devices shall be installed per the manufacturer recommendation.

b. Locate components of the BMS in accessible local control panels wherever possible.

c. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.

d. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.

e. Outside Air Sensors

   i. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outdoor air conditions accurately.

   ii. Sensors shall be installed with a rain proof, perforated cover.

f. Water Differential Pressure Sensors

   i. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.

   ii. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.

   iii. The transmitters shall be installed in an accessible location wherever possible.

g. Medium to High Differential Water Pressure Applications (Over 21” WC)

   i. Air bleed units, bypass valves and compression fittings shall be provided.

h. Building Differential Air Pressure Applications (-0.5” to +0.5” WC)

   i. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.

   ii. The interior tip shall be inconspicuous and located as shown on the drawings.

i. Air Flow Measuring Stations

   i. Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct.

   ii. Station flanges shall be two inch to three inch to facilitate matching connecting ductwork.

j. Duct Temperature Sensors

   i. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.

   ii. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.

   iii. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.

   iv. The sensor shall be mounted to suitable supports using factory approved element holders.

k. Space Sensors

   i. Shall be mounted per ADA requirements.

   ii. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.

l. Low Temperature Limit Switches

i. Install on the discharge side of the first water or steam coil in the air stream.

ii. Mount element horizontally across duct in a serpentine pattern ensuring each square foot of coil is protected by 1 foot of sensor.

iii. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.

m. Air Differential Pressure Status Switches

i. Install with static pressure tips, tubing, fittings, and air filter.

n. Water Differential Pressure Status Switches

i. Install with shut off valves for isolation.

o. HVAC Output Devices

i. All output devices shall be installed per the manufacturers' recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.

ii. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.

iii. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.

iv. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI. The maximum pressure drop for steam applications shall be 7 PSI.

v. Electronic Signal Isolation Transducers: Whenever an analog output signal from the BMS is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems.

3.C Training

1. The BMS contractor shall provide the following training services:

a. 16 hours of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BMS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.

3.D Commissioning Requirements

1. Fully commission all aspects of the BMS work.

2. Acceptance Check Sheet

a. Prepare a check sheet that includes all points for all functions of the BMS as indicated on the point list included in this specification.

b. Submit the check sheet to the Engineer for approval.

3. Equipment performance verification and documentation:

a. The BMS Contractor shall test each equipment unit for operation and correct flow. At each step, after a settling time, box air flows and damper positions will be sampled. Following the tests, a pass/fail report indicating results shall be produced. Possible results are Pass, No change in flow between full open and full close, Reverse operation or Maximum flow not achieved. The report shall be submitted as documentation of the installation.

b. The BMS Contractor shall issue a report based on a sampling of the Fan Coil calculated loop performance metrics. The report shall indicate performance criteria, include the count of conforming and non-conforming boxes, list the non-conforming boxes along with their performance data, and shall also include graphical representations of performance.

c. Promptly rectify all listed deficiencies and submit a document summarizing completion to the Engineer.

3.E Performance Verification

1. The installing contractor shall perform a complete Performance Verification (PV) of the Building management system three times throughout the project:

a. At project turnover to customer.

b. At six (6) months of project operation.

c. At twelve (12) months of project operation or end of warranty.

2. Performance Verification shall include a complete and current Building Automation System site inventory including the following information at a minimum: a listing of all field and supervisory controllers with the following key attribute data; corresponding model numbers, firmware versions, available security updates, CPU and memory performance data, battery conditions, integrations, controlled equipment, and device and point counts.

3. Performance Verification shall include a complete written evaluation of system configuration and performance in the following categories:

a. Security – The Security evaluation shall include information about controllers that require security updates and conformance of user accounts to latest security rules and best practices.

b. Energy Performance – The Energy Performance and Savings evaluation shall identify opportunities through schedule and nightly setbacks, economizers, eliminating simultaneous heating and cooling and adding VSD to equipment.

c. Comfort and Health – The Comfort and Health evaluation shall identify temperature, pressure, and carbon dioxide values that deviate from desired set points that could lead to occupant discomfort.

d. Reliability – The Reliability evaluation shall identify overridden control points, control points creating excessive alarms, and opportunities to adding control points and trends to further enable system functionality.

e. Standards – The Standards evaluation shall identify conformance to published standards for point count, network performance and protocol standards.

4. Provide all reports as specified on a new, USB compatible flash drive.

SECTION 23 17 10 – VARIABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Drawings and general provisions of Contact, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.2 PRINCIPAL WORK IN THIS SECTION

A. Variable frequency drives.

B. Materials, equipment, fabrication, installation and tests, in conformity with applicable codes and authorities having jurisdiction, for variable frequency drives (VFD’s).

1.3 QUALITY ASSURANCE

A. Refer to General Provisions.

B. Manufacturer: Company specializing in manufacture of variable frequency drives and their accessories, with minimum ten years documented product development, testing, and manufacturing experience in the horsepower range required.

C. VFD's shall have a minimum MTBF (mean time between failure) rating of 28 years.

1.4 SUBMITTALS

A. Submit product data, drawings and diagrams for the following items per the provisions of Division 1 and this Division’s General provisions:

1. Product data: Manufacturer’s catalog cuts, ratings and installation instructions.

2. Drawings: Scale drawings of assembly.

3. Diagrams: wiring diagrams including all external connections.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Variable Frequency Drives:

1. Square D.

2. ABB

3. Danfoss Graham.

2.2 VARIABLE FREQUENCY DRIVES

A. General:

1. Motors shall be provided with UL Listed variable frequency drive (VFD) control systems.

2. Motors shall be provided with a microprocessor based, pulse width modulated (PWM) variable frequency drive (VFD) control systems as specified or noted.

3. The adjustable frequency AC motor drive shall be designed to convert the 60 hertz input power to adjustable frequency output power. The output frequency and voltage of the drive shall be adjustable such that a constant volts/Hz ratio is determined from the design parameters of the driven motor.

4. Drive shall be capable of operating any standard squirrel cage induction motor with load rating within the capacity of the drive. At any time in the future, it shall be possible to substitute a new or rewound motor in the field without requiring modification of the drive.

5. For retrofit projects, Contractor shall be familiar with existing motor conditions. Existing motor must have a 1.15 service factor and Class B insulation. VFD shall be sized for current voltage and HP of existing motor. Any motors not meeting these minimum requirements shall be replaced and provided by the Contractor.

6. For maintenance purposes, drive shall be capable of starting, stopping and running with stable operation with the motor completely disconnected (no load).

7. Input AC line reactor shall be provided by manufacturers of VFD.

B. Features:

1. Drive enclosure shall be a NEMA Type 1 or equivalent, wall or floor mounted, metal cabinet with hinged front access door(s), filtered ventilation system (if required), and controls that are mounted, wired and tested.

2. Fused, interlocked disconnect switch or input line circuit breaker, externally operated, interlocked with enclosure door. Short circuit interrupting rating of 200,000 amps.

3. Internal 115 VAC control power circuit with transformer and primary and secondary protective fuses.

4. One normally open and one normally closed contacts from run relay, wired to terminal for customer use. Contactors to enable control of drive from a central control system for start/stop and load shed operation through remote speed reset.

5. Controlled acceleration and deceleration, separately adjustable, shall be provided from 0.5 to 200 seconds with torque limit override acceleration protection and regeneration protection during deceleration.

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6. Drive shall automatically adjust the volts/Hz ratio to the motor in proportion to its load without changing speed in order to conserve the maximum amount of energy.

7. Separately adjustable maximum and minimum frequency limits shall be provided.

8. Low frequency/low voltage start with linearly adjustable ramp up to pre-selected speed.

9. All components shall be accessible from the cabinet door for service. Drive must be designed for side-by-side, back-to-back and against-the-wall installation.

10. Digitally displayed AC ammeter and percent load meter, located on door.

11. Digitally displayed speed control and speed indicator, located on door.

12. Digitally displayed voltmeter, located on door.

13. Hand/off/auto switch with start/stop pushbuttons or switches.

    a. In the "hand" position, the speed is controlled by the door mounted speed control and the start/stop commands are controlled by the door mounted start/stop pushbuttons or switches.

    b. In the "off" position, the drive cannot be started.

    c. In the "auto" position, the speed is controlled by a remote electronic signal and the drive can receive only a remote start command (momentary contact closure). The stop command in the auto position can be either remote or from the door mounted stop pushbutton or switch (to ensure maximum safety).

    d. To facilitate equipment setup, the drive shall not undergo complete shutdown when moving the selector switch from the hand position to the auto position.

14. Drive fault alarm contact for remote indication.

15. Automatic reset of drive to receive start command after any normal shutdown, including power outages.

16. Remote electrical input signal for speed control(to be coordinated with control Contractor).

17. Critical speed rejection circuit.

18. Drive shall be constructed with integral protection against all normal transients and surges in the incoming power line, any grounding or disconnecting of the output power line, and any interruption or runaway of the incoming speed reference signal. Protection is defined as a normal shutdown or return to original speed with no component damage.

19. Drive shall protect itself against all phase-to-phase and phase-to-ground faults.

20. Drive shall protect itself against any removal of load.

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21. Drive shall employ adjustable torque limit control to override the speed command and decrease the frequency while maintaining the correct volts/Hz ratio whenever the load level surpasses the drive design level.

22. Drive shall protect itself against single-phasing and power outages and shall be insensitive to input phase rotation.

23. Drive shall start into a spinning motor or shut down with no component damage.

24. Drive shall ride through any input power dip of three cycles or less.

25. Drive shall go through an orderly shutdown when the incoming voltage low limit is surpassed.

26. Instantaneous overcurrent trip (IOT) shall continuously monitor peak currents. It shall provide instantaneous shutdown without component failure when high limit setting is surpassed.

27. Torque limit shall be settable from 50 to 100 percent of full drive rating on variable torque loads. When torque limit engages, the output frequency is steadily reduced until the load reduces to the design capacity. At that point, the speed will stabilize. If the load reduces further, the drive shall re-accelerate to the preset speed.

28. Manual bypass shall be provided when indicated by the schedule. VFD and bypass components shall be mounted inside a common NEMA 1 enclosure, fully pre-wired and ready for installation as a single UL listed device. Bypass shall include the following:

    a. Input, output, and bypass contactors, to disconnect power to the VFD, when the motor is running in the bypass mode.

    b. 115 V.A.C. control transformer, with fused primary.

    c. Thermal overload relay, to protect the motor while operating in the bypass mode.

    d. Circuit breaker/disconnect switch, with a “through-the-door” handle mechanism.

    e. Control and safety circuit terminal strip.

    f. “Drive-Off-Bypass” selector switch.

    g. Pilot lights for “Power On” and “Fault”.

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h. "Normal/Test" selector switch, to allow testing and adjustment of the VFD while the motor is running in the bypass mode.

29. UL listed, nonlinear isolation transformer to prevent noise and harmonic feedback to electrical system. Shall be mounted in NEMA 1 enclosure and be of dry type construction with Class H insulation. Transformer shall be provided by variable frequency drive manufacturer to match performance of variable frequency drive(s).

30. The VFD must meet the requirements for Radio Frequency Interference (RFI) above 7 MHz as specified by FCC regulations, part 15, subpart J, Class A devices.

31. A digital diagnostic system which monitors its own control functions and displays faults and operating conditions.

32. Operating conditions:

a. Line voltage variations: +10 percent, -5 percent.

b. Line frequency variations: ±2 hertz.

c. Overload capability of up to 130 percent of full drive rating for variable torque loads.

d. Ambient temperature: 0°C to 40°C.

e. Maximum altitude limit: 3,300 feet.

f. Maximum humidity: 95 percent (non-condensing).

g. Efficiency in excess of 95 percent at full load/full speed and in excess of 80 percent at half speed on a variable torque load (cubic load).

33. Serial communication.

34. VFD shall be capable of PID (Proportional, Integral, Derivative) logic, to provide closed-loop setpoint control capability, from a remote reference. In addition, an energy saving sleep function should be used in conjunction with the PID control. The SLEEP function reduces the unnecessary operation of equipment. When the SLEEP function senses a minimal deviation of a sensor (pressure, temperature), the system reacts by removing the run signal from the equipment. Upon receiving an ample sensor signal deviation, the equipment returns the run signal and resumes normal operation.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Coordinate drive equipment with motors supplied under Motors and Motor Controllers.

C. Factory representative shall inspect final installation of all drives and connected wiring and make all final adjustments to meet specified performance.

3.2 TESTS

A. Manufacturer shall conduct factory tests to assure conformance to specification requirements.

B. All power components shall be run-tested under specified temperature and load conditions.

C. Complete records of test procedure and results shall be made available at no cost to Owner's representative.

3.3 TRAINING

A. Factory representative shall provide on-site training of operating personnel after the system is fully operational.

3.4 WARRANTY

A. Three-year warranty from date of shipment.

END OF SECTION

SECTION 23 21 13 – HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Hot-water heating piping.
2. Chilled-water piping.
3. Condenser-water piping.
4. Makeup-water piping.
5. Condensate-drain piping.
6. Air-vent piping.
7. Safety-valve-inlet and -outlet piping.

B. Related Sections include the following:

1. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

1.3 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:

1. Hot-Water Heating Piping: 150 psig at 200 deg F.
2. Chilled-Water Piping: 150 psig at 200 deg F.
3. Condenser-Water Piping: 150 psig at 200 deg F.
4. Makeup-Water Piping: 80 psig at 150 deg F.
5. Condensate-Drain Piping: 150 deg F.
6. Blowdown-Drain Piping: 200 deg F.
7. Air-Vent Piping: 200 deg F.
8. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Welding certificates.

C. Shop Drawings:
   1. Building information modeling (BIM) process shall be performed at an LOD-400 level as part of developing the shop drawing and includes but is not limited to creating model of 3D objects in Revit or AutoCAD based program, modeling objects accurately based on actual cut lengths and with access and clearance requirements incorporated, and coordinating with all MEP trades.
   2. Deliverables to engineer: Detail, 1/4 inch equals 1 foot scale drawings.

D. Qualification Data: For Installer.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

G. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

1.6 EXTRA MATERIALS

A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

A. Wrought-Copper Fittings: ASME B16.22.

   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

      a. Anvil International, Inc.
      b. S. P. Fittings; a division of Star Pipe Products.
      c. Victaulic Company of America.

2. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
3. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, prelubricated EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.

B. Copper or Bronze Pressure-Seal Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Stadler-Viega.

2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig working-pressure rating at 250 deg F.

C. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. T-DRILL Industries Inc.

D. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

H. Grooved Mechanical-Joint Fittings and Couplings:

1. NOT PERMITTED.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Hart Industries International, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.

2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
3. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Calpico, Inc.
b. Lochinvar Corporation.

2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Perfection Corporation; a subsidiary of American Meter Company.
   b. Precision Plumbing Products, Inc.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Victaulic Company of America.

2. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.5 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Armstrong Pumps, Inc.
   b. Bell & Gossett Domestic Pump; a division of ITT Industries.
   c. Flow Design Inc.
   d. Gerand Engineering Co.
   e. Griswold Controls.
   f. Taco.

2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Armstrong Pumps, Inc.
   b. Bell & Gossett Domestic Pump; a division of ITT Industries.
   c. Flow Design Inc.

d. Gerand Engineering Co.
e. Griswold Controls.
f. Taco.
g. Tour & Andersson; available through Victaulic Company of America.

2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig.
11. Maximum Operating Temperature: 250 deg F.

E. Diaphragm-Operated, Pressure-Reducing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett Domestic Pump; a division of ITT Industries.
d. Conbraco Industries, Inc.
e. Spence Engineering Company, Inc.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: Stainless Steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Diaphragm-Operated Safety Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett Domestic Pump; a division of ITT Industries.
d. Conbraco Industries, Inc.
e. Spence Engineering Company, Inc.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: Bronze or brass.

3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: Stainless Steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Automatic Flow-Control Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flow Design Inc.
b. Griswold Controls.

2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: [Stainless steel] [Corrosion resistant], tamper proof, self cleaning, and removable.
4. Combination Assemblies: Include bonze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig.
9. Maximum Operating Temperature: 250 deg F.

2.6 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Taco.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

C. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.

D. Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested with taps fabricated and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.
3. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
4. Gage Glass: Full height with dual manual shutoff valves, [3/4-inch-] <Insert dimension> diameter gage glass, and slotted-metal glass guard.

E. Bladder-Type Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

F. Combination Air and Dirt Separators:

1. Full-flow coalescing type combination air eliminator and dirt separator shall be fabricated steel, rated for 150 psig working pressure, stamped and registered in accordance with ASME Section VIII, Division 1 for unfired pressure vessels, and include two equal chambers above and below the inlet / outlet nozzles.
2. Unit shall include internal structured elements filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100% free air, 100% entrained air, and 99.6% dissolved air at the installed location. Dirt separation efficiency shall be a minimum of 80% of all particles 30 micron and larger within 100 passes. The elements must be fabricated by the manufacturer and consist of a copper core tube with continuous wound copper wire medium permanently attached and followed by a separate continuous wound copper wire permanently affixed.
3. Each unit shall have a separate venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be an integral full port float actuated brass venting mechanism. Units shall include a side tap valve to flush floating dirt or liquids and for quick bleeding of large amounts of air during

system fill or refill. Unit shall be manufactured with a removable lower head for internal inspection.
4. Maximum Working Pressure: Up to 150 psig.
5. Maximum Operating Temperature: Up to 300 deg F.

2.7 CHEMICAL TREATMENT

A. Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

B. Ethylene and Propylene Glycol: Industrial grade with corrosion inhibitors and environmental-stabilizer additives for mixing with water in systems indicated to contain antifreeze or glycol solutions.

2.8 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: [40] [60]-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: [40] [60]-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: [40] [60]-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

D. Stainless-Steel Bellow, Flexible Connectors:

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1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

E. Expansion fittings are specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Dual-water piping, aboveground, [NPS 2 and smaller,] shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Schedule 40 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Dual-water piping, aboveground, [NPS 2-1/2 and larger,] shall be the following:
1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

A. Makeup-water piping installed aboveground shall be the following:

1. Type L drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

B. Condensate-Drain Piping: Type [M], drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

C. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

D. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

E. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install throttling-duty valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

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N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

U. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
2. NPS 1: Maximum span, 7 feet; minimum rod size, 3/8 inch.

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3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 1/2 inch.
7. NPS 3: Maximum span, 12 feet; minimum rod size, 1/2 inch.
8. NPS 3-1/2: Maximum span, 13 feet; minimum rod size, 1/2 inch.
9. NPS 4: Maximum span, 14 feet; minimum rod size, 5/8 inch.
10. NPS 5: Maximum span, 16 feet; minimum rod size, 5/8 inch.
11. NPS 6: Maximum span, 17 feet; minimum rod size, 3/4 inch.
12. NPS 8: Maximum span, 19 feet; minimum rod size, 3/4 inch.
13. NPS 10: Maximum span, 22 feet; minimum rod size, 7/8 inch.
14. NPS 12: Maximum span, 23 feet; minimum rod size, 7/8 inch.
15. NPS 14: Maximum span, 25 feet; minimum rod size, 1 inch.
16. NPS 16: Maximum span, 27 feet; minimum rod size, 1 inch.
17. NPS 18: Maximum span, 28 feet; minimum rod size, 1 inch.
18. NPS 20: Maximum span, 30 feet; minimum rod size, 1-1/4 inches.

E. Install hangers for drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 3/8 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 3/8 inch.
3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 1/2 inch.
7. NPS 3: Maximum span, 10 feet; minimum rod size, 1/2 inch.

F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

D. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.

E. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

F. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above the floor. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

G. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

H. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

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B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 CHEMICAL TREATMENT

A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the following water characteristics:

1. pH: 9.0 to 10.5.
2. "P" Alkalinity: 100 to 500 ppm.
3. Boron: 100 to 200 ppm.
4. Chemical Oxygen Demand: Maximum 100 ppm.
5. Corrosion Inhibitor:
    a. Sodium Nitrate: 1000 to 1500 ppm.
    b. Molybdate: 200 to 300 ppm.
    c. Chromate: 200 to 300 ppm.
    d. Sodium Nitrate Plus Molybdate: 100 to 200 ppm each.
    e. Chromate Plus Molybdate: 50 to 100 ppm each.
6. Soluble Copper: Maximum 0.20 ppm.
7. Tolyiriazole Copper and Yellow Metal Corrosion Inhibitor: Minimum 10 ppm.
8. Total Suspended Solids: Maximum 10 ppm.
9. Ammonia: Maximum 20 ppm.
10. Free Caustic Alkalinity: Maximum 20 ppm.
11. Microbiological Limits:
    a. Total Aerobic Plate Count: Maximum 1000 organisms/ml.
    b. Total Anaerobic Plate Count: Maximum 100 organisms/ml.
    c. Nitrate Reducers: 100 organisms/ml.
    d. Sulfate Reducers: Maximum 0 organisms/ml.
    e. Iron Bacteria: Maximum 0 organisms/ml.

B. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

C. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

3.9 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION

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SECTION 23 21 15 – UNDERGROUND HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Cased piping system.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing hydronic piping systems with the following minimum working-pressure ratings:

   1. Dual-Water Piping: 150 psig at 200 deg F.

1.4 SUBMITTALS

A. Product Data: For the following:

   1. Conduit piping.
   2. Cased piping.
   3. Loose-fill insulation.

B. Shop Drawings: For underground hydronic piping. Signed and sealed by a professional engineer.

   1. Calculate requirements for expansion compensation for underground piping.
   2. Show expansion compensators, offsets, and loops with appropriate materials to allow piping movement in the required locations. Show anchors and guides that restrain piping movement with calculated loads, and show concrete thrust block dimensions.
   3. Show pipe sizes, locations, and elevations. Show piping in trench, conduit, and cased pipe with details showing clearances between piping, and show insulation thickness.

C. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1/8 inch equals 1 feet. Show types, sizes, materials, and elevations of other utilities crossing hydronic piping.

D. Qualification Data: For qualified Installer.

E. Welding certificates.

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F. Material Test Reports: For cased piping.

G. Source quality-control reports.

H. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31.1.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

PART 2 - PRODUCTS

2.1 CASED PIPING SYSTEM

A. Description: Factory-fabricated piping with carrier pipe, insulation, and casing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Perma-Pipe, Inc.
   b. Rovanco Piping Systems, Inc.
   c. Thermacor Process, L.P.
   d. Thermal Pipe Systems.

B. Carrier Pipe:
1. SCH 40, steel pipe and fittings
2. Factory fabricated fittings shall be pre-fabricated, insulated, and attached to pipe at the factory.

C. Carrier Pipe Insulation:

1. Polyurethane Foam Pipe Insulation: Rigid, cellular, high-pressure injected between carrier pipe and jacket.

   a. Comply with ASTM C 591; thermal conductivity (k-value) shall not exceed 0.14 Btu x in./h x sq. ft. x deg F at 75 deg F after 180 days of aging.

D. Casing: HDPE

E. Casing accessories include the following:

1. Joint Kit: Half-shell, pourable or split insulation, casing sleeve, and shrink-wrap sleeve.

2. Expansion Blanket: Elastomeric foam, formed to fit over piping.
3. End Seals: Shrink wrap the casing material to seal watertight around casing and carrier pipe.

PART 3 - EXECUTION

3.1 EARTHWORK

A. See Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATION

A. Dual-Water Heating Piping:

1. NPS 2-1/2 and larger shall be the following:
   a. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

2. Cased piping with polyurethane carrier-pipe insulation.

   a. Piping Insulation Thickness: 2 inches.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Remove standing water in the bottom of trench.

C. Do not backfill piping trench until field quality-control testing has been completed and results approved.

D. Install piping at uniform grade of 0.2 percent. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points and elsewhere as required for system drainage. Install manual air vents at high points.

E. In conduits, install drain valves at low points and manual air vents at high points.

F. Install components with pressure rating equal to or greater than system operating pressure.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. See Division 23 Section "Common Work Results for HVAC" for sleeves and mechanical sleeve seals through exterior building walls.

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J. Secure anchors with concrete thrust blocks. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."

K. See Division 26 Section "Cathodic Protection" for cathodic devices and connections to piping and conduit systems.

3.4 JOINT CONSTRUCTION

A. See Division 33 Section "Common Work Results for Utilities" for basic piping joint construction.

B. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

D. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

E. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

3.5 IDENTIFICATION

A. Install continuous plastic underground warning tapes during back filling of trenches for underground hydronic piping. Locate tapes 6 to 8 inches below finished grade, directly over piping. See Division 31 Section "Earth Moving" for warning-tape materials and devices and their installation.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Prepare hydronic piping for testing according to ASME B31.9 and as follows:

a. Leave joints, including welds, uninsulated and exposed for examination during test.

b. Fill system with water. Where there is risk of freezing, air or a safe, compatible liquid may be used.
c. Use vents installed at high points to release trapped air while filling system.

2. Test hydronic piping as follows:

a. Subject hydronic piping to hydrostatic test pressure that is not less than 1.5 times the design pressure.
b. After hydrostatic test pressure has been applied for 10 minutes, examine joints for leakage. Remake leaking joints using new materials and repeat hydrostatic test until no leaks exist.

3. Engage factory authorized representative during construction and installation of pre-engineered system for verification of compliance.

E. Prepare test and inspection reports.

END OF SECTION

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SECTION 23 22 13 - STEAM AND CONDENSATE HEATING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following for LP and HP steam and condensate piping:

1. Pipe and fittings.
2. Strainers.
3. Flash tanks.
4. Safety valves.
5. Pressure-reducing valves.
6. Steam traps.
7. Thermostatic air vents and vacuum breakers.
8. Steam and condensate meters.

1.3 DEFINITIONS

A. HP Systems: High-pressure piping operating at more than 15 psig as required by ASME B31.1.

B. LP Systems: Low-pressure piping operating at 15 psig or less as required by ASME B31.9.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures:

1. HP Steam Piping: 80 psig.
2. LP Steam Piping: 10 psig.
3. Condensate Piping: 15 psig and gravity.
4. Makeup-Water Piping: 80 psig.
5. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.
6. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
7. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

1.5 SUBMITTALS

A. Product Data: For each type of the following:

1. Pressure-reducing and safety valve.
2. Steam trap.
3. Air vent and vacuum breaker.
4. Flash tank.
5. Meter.

B. Shop Drawings:
1. Building information modeling (BIM) process shall be performed at an LOD-400 level as part of developing the shop drawing and includes but is not limited to creating model of 3D objects in Revit or AutoCAD based program, modeling objects accurately based on actual cut lengths and with access and clearance requirements incorporated, and coordinating with all MEP trades.
2. Deliverables to engineer: Detail, 1/4 inch equals 1 foot scale drawings including elements: flash tank assemblies and fabrication of pipe anchors, hangers, pipe, multiple pipes, alignment guides, and expansion joints and loops and their attachment to the building structure. Detail locations of anchors, alignment guides, and expansion joints and loops.

C. Qualification Data: For Installer.

D. Welding certificates.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For valves, safety valves, pressure-reducing valves, steam traps, air vents, vacuum breakers, and meters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code - Steel."

B. Pipe Welding: Qualify processes and operators according to the following:

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. ASME Compliance: Comply with [ASME B31.1, "Power Piping"] [and] [ASME B31.9, "Building Services Piping"] for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp flash tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, plain ends, Type, Grade, and Schedule as indicated in Part 3 piping applications articles.

B. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300 as indicated in Part 3 piping applications articles.

C. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 piping applications articles.

D. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

E. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

F. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, black steel of same Type, Grade, and Schedule as pipe in which installed.

G. Stainless-Steel Bellows, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforced, protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150-psig.
5. Maximum Operating Temperature: 250 deg F.

2.2 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

D. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

2.3 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Stop-Check Valves:

1. Body and Bonnet: Malleable iron.
2. End Connections: Flanged.
3. Disc: Cylindrical with removable liner and machined seat.
4. Stem: Brass alloy.
5. Operator: Outside screw and yoke with cast-iron handwheel.
6. Packing: Polytetrafluoroethylene-impregnated packing with two-piece packing gland assembly.
7. Pressure Class: 250.

2.4 STRAINERS

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for strainers NPS 2 and smaller; flanged ends for strainers NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 20 mesh strainer, and perforated stainless-steel basket with 50 percent free area.
4. Tapped blowoff plug.
5. CWP Rating: 250-psig working steam pressure.

B. Basket Strainers:

1. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for strainers NPS 2 and smaller; flanged ends for strainers NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 20 mesh strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 250-psig working steam pressure.

2.5 FLASH TANKS

A. Shop or factory fabricated of welded steel according to ASME Boiler and Pressure Vessel Code, for 150-psig rating; and bearing ASME label. Fabricate with tappings for low-pressure steam and condensate outlets, high-pressure condensate inlet, air vent, safety valve, and legs.

2.6 SAFETY VALVES

A. Bronze Safety Valves:

1. Disc Material: Forged copper alloy.
2. End Connections: Threaded inlet and outlet.
3. Spring: Fully enclosed steel spring with adjustable pressure range and positive shutoff, factory set and sealed.
4. Pressure Class: 250.
5. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
6. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.

2.7 PRESSURE-REDUCING VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong International, Inc.
2. Hoffman Specialty; Division of ITT Industries.
3. Spirax Sarco, Inc.

B. Size, Capacity, and Pressure Rating: Factory set for inlet and outlet pressures indicated.

C. Description: Pilot-actuated, diaphragm type, with adjustable pressure range and positive shutoff.

D. Body: Cast iron.

E. End Connections: Threaded connections for valves NPS 2 and smaller and flanged connections for valves NPS 2-1/2 and larger.

F. Trim: Hardened stainless steel.

G. Head and Seat: Replaceable, main head stem guide fitted with flushing and pressure-arresting device cover over pilot diaphragm.

H. Gaskets: Non-asbestos materials.

2.8 STEAM TRAPS

A. Thermostatic Traps:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.
b. Hoffman Specialty; Division of ITT Industries.
c. Spirax Sarco, Inc.

2. Body: Bronze angle-pattern body with integral union tailpiece and screw-in cap.
3. Trap Type: Balanced-pressure.
4. Bellows: Stainless steel or monel.
5. Head and Seat: Replaceable, hardened stainless steel.
6. Pressure Class: 125.

B. Thermodynamic Traps:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong International, Inc.
    b. Hoffman Specialty; Division of ITT Industries.
    c. Spirax Sarco, Inc.

2. Body: Stainless steel with screw-in cap.
3. End Connections: Threaded.
4. Disc and Seat: Stainless steel.
5. Maximum Operating Pressure: 600 psig.

C. Float and Thermostatic Traps:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong International, Inc.
    b. Hoffman Specialty; Division of ITT Industries.
    c. Spirax Sarco, Inc.

2. Body and Bolted Cap: ASTM A 126, cast iron.
3. End Connections: Threaded.
4. Float Mechanism: Replaceable, stainless steel.
5. Head and Seat: Hardened stainless steel.
6. Trap Type: Balanced pressure.
7. Thermostatic Bellows: Stainless steel or monel.
8. Thermostatic air vent capable of withstanding 45 deg F of superheat and resisting water hammer without sustaining damage.
9. Vacuum Breaker: Thermostatic with phosphor bronze bellows, and stainless steel cage, valve, and seat.
10. Maximum Operating Pressure: 125 psig.

D. Inverted Bucket Traps:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong International, Inc.
    b. Hoffman Specialty; Division of ITT Industries.
    c. Spirax Sarco, Inc.

2. Body and Cap: Cast iron.
3. End Connections: Threaded.
4. Head and Seat: Stainless steel.
5. Valve Retainer, Lever, and Guide Pin Assembly: Stainless steel.

6. Bucket: Brass or stainless steel.
7. Strainer: Integral stainless-steel inlet strainer within the trap body.
8. Air Vent: Stainless-steel thermostatic vent.
9. Pressure Rating: 250 psig.

2.9 THERMOSTATIC AIR VENTS AND VACUUM BREAKERS

A. Thermostatic Air Vents:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armstrong International, Inc.
      b. Hoffman Specialty; Division of ITT Industries.
      c. Spirax Sarco, Inc.
   2. Body: Cast iron, bronze or stainless steel.
   3. End Connections: Threaded.
   4. Float, Valve, and Seat: Stainless steel.
   5. Thermostatic Element: Phosphor bronze bellows in a stainless-steel cage.
   6. Pressure Rating: [125 psig] [300 psig] <Insert pressure>.
   7. Maximum Temperature Rating: [350 deg F] <Insert temperature>.

B. Vacuum Breakers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armstrong International, Inc.
      b. Hoffman Specialty; Division of ITT Industries.
      c. Spirax Sarco, Inc.
   2. Body: Cast iron, bronze, or stainless steel.
   3. End Connections: Threaded.
   4. Sealing Ball, Retainer, Spring, and Screen: Stainless steel.
   5. O-ring Seal: EPR.
   6. Pressure Rating: [125 psig] [300 psig] <Insert pressure>.
   7. Maximum Temperature Rating: [350 deg F] <Insert temperature>.

PART 3 - EXECUTION

3.1 LP STEAM PIPING APPLICATIONS

A. LP Steam Piping, NPS 2 and Smaller: Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

B. LP Steam Piping, NPS 2-1/2 through NPS 12: Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

C. Condensate piping above grade, NPS 2 and smaller, shall be the following:

1. Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

D. Condensate piping above grade, NPS 2-1/2 and larger, shall be the following:

1. Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

3.2 HP STEAM PIPING APPLICATIONS

A. HP Steam Piping, NPS 2 and Smaller: Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

B. HP Steam Piping, NPS 2-1/2 through NPS 12: Schedule 40, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

C. Condensate piping above grade, NPS 2 and smaller, shall be the following:

1. Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

D. Condensate piping above grade, NPS 2-1/2 and larger, shall be the following:

1. Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

3.3 ANCILLARY PIPING APPLICATIONS

A. Makeup-water piping installed above grade shall be the following:

1. Drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

B. Makeup-Water Piping Installed below Grade and within Slabs: Annealed-temper copper tubing, wrought-copper fittings, and soldered joints. Use the fewest possible joints.

C. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

D. Air-Vent Piping:

1. Inlet: Same as service where installed.
2. Outlet: Type K annealed-temper copper tubing with soldered or flared joints.

E. Vacuum-Breaker Piping: Outlet, same as service where installed.

F. Safety-Valve-Inlet and -Outlet Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

3.4 VALVE APPLICATIONS

A. Install shutoff duty valves at branch connections to steam supply mains, at steam supply connections to equipment, and at the outlet of steam traps.

B. Install safety valves on pressure-reducing stations and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

3.5 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Use indicated piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install piping to allow application of insulation.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

K. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

L. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.

M. Install condensate return piping at a minimum uniform grade of 0.4 percent downward in direction of condensate flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side down.

O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to top of main pipe.

P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

U. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

V. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, and control valves.

1. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet.
2. Size drip legs same size as main. In steam mains NPS 6 and larger, drip leg size can be reduced, but to no less than NPS 4.

W. Flash Tank:

1. Pitch condensate piping down toward flash tank.
2. If more than one condensate pipe discharges into flash tank, install a check valve in each line.
3. Install thermostatic air vent at tank top.
4. Install safety valve at tank top.
5. Install full-port ball valve, and swing check valve on condensate outlet.
6. Install inverted bucket or float and thermostatic trap at low-pressure condensate outlet, sized for three times the calculated heat load.
7. Install pressure gage on low-pressure steam outlet according to Division 23 Section "Meters and Gages for HVAC Piping."

3.6 STEAM-TRAP INSTALLATION

A. Install steam traps in accessible locations as close as possible to connected equipment.

B. Install full-port ball valve, strainer, and union upstream from trap; install union, check valve, and full-port ball valve downstream from trap unless otherwise indicated.

3.7 PRESSURE-REDUCING VALVE INSTALLATION

A. Install pressure-reducing valves in accessible location for maintenance and inspection.

B. Install bypass piping around pressure-reducing valves, with globe valve equal in size to area of pressure-reducing valve seat ring, unless otherwise indicated.

C. Install gate valves on both sides of pressure-reducing valves.

D. Install unions or flanges on both sides of pressure-reducing valves having threaded- or flanged-end connections respectively.

E. Install pressure gages on low-pressure side of pressure-reducing valves after the bypass connection according to Division 23 Section "Meters and Gages for HVAC Piping."

F. Install strainers upstream for pressure-reducing valve.

G. Install safety valve downstream from pressure-reducing valve station.

3.8 SAFETY VALVE INSTALLATION

A. Install safety valves according to ASME B31.1, "Power Piping”

B. Pipe safety-valve discharge without valves to atmosphere outside the building.

C. Install drip-pan elbow fitting adjacent to safety valve and pipe drain connection to nearest floor drain.

D. Install exhaust head with drain to waste, on vents equal to or larger than NPS 2-1/2.

3.9 HANGERS AND SUPPORTS

A. Install hangers and supports according to Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with requirements below for maximum spacing.

B. Seismic restraints are specified on plan per OPM #0043-13

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.

D. Install hangers with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 9 feet; minimum rod size, 3/8 inch.
2. NPS 1: Maximum span, 9 feet; minimum rod size, 3/8 inch.

3. NPS 1-1/2: Maximum span, 12 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 13 feet; minimum rod size, 1/2 inch.
5. NPS 2-1/2: Maximum span, 14 feet; minimum rod size, 1/2 inch.
6. NPS 3: Maximum span, 15 feet; minimum rod size, 1/2 inch.
7. NPS 4: Maximum span, 17 feet; minimum rod size, 1/2 inch.
8. NPS 6: Maximum span, 21 feet; minimum rod size, 1/2 inch.

3.10 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube ends. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.11 TERMINAL EQUIPMENT CONNECTIONS

A. Size for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install traps and control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install vacuum breakers downstream from control valve, close to coil inlet connection.

E. Install a drip leg at coil outlet.

3.12 FIELD QUALITY CONTROL

A. Prepare steam and condensate piping according to ASME B31.1, "Power Piping" and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush system with clean water. Clean strainers.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

B. Perform the following tests on steam and condensate piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.
3. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

C. Prepare written report of testing.

END OF SECTION

SECTION 23 23 00 – REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 185 psig (1276 kPa).
2. Suction Lines for Heat-Pump Applications: 325 psig (2241 kPa).
3. Hot-Gas and Liquid Lines: 325 psig (2241 kPa).

1.3 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.4 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.5 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L (ASTM B 88M, Type A or B).

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
4. Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

2.2 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig (3450 kPa).
7. Maximum Operating Temperature: 275 deg F (135 deg C).

B. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig (3450 kPa).

C. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
2. Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Seat Disc: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Working Pressure Rating: 400 psig (2760 kPa).
6. Maximum Operating Temperature: 240 deg F (116 deg C).

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D. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg F (4.4 deg C).
6. Superheat: Nonadjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 450 psig (3100 kPa).

E. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig (3450 kPa).
5. Maximum Operating Temperature: 275 deg F (135 deg C).

F. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig (3450 kPa).
6. Maximum Operating Temperature: 275 deg F (135 deg C).

G. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig (3450 kPa).
7. Maximum Operating Temperature: 240 deg F (116 deg C).

H. Replaceable-Core Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig (14 kPa).

8. Working Pressure Rating: 500 psig (3450 kPa).
9. Maximum Operating Temperature: 240 deg F (116 deg C).

2.3 REFRIGERANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-410A: Difluoromethane and Pentafluoroethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Suction Lines NPS 1-1/2 (DN 40) and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Suction Lines NPS 2 to NPS 4 (DN 50 to DN 100) for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

D. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at strainers if they are not an integral part of strainers.

C. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

D. Install a full-sized, three-valve bypass around filter dryers.

E. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.

2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

F. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

G. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

H. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Compressor.

I. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

J. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

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J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install piping per equipment manufacturers requirements and guidelines for slope, distance, changes in direction, changes in elevation and branching.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install pipe sleeves at penetrations in exterior walls and floor assemblies.

Q. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."

R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

S. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

T. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.

U. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 PIPE JOINT CONSTRUCTION

A. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

B. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet (6 m) or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).
4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
5. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
6. NPS 2 (DN 50): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
7. NPS 2-1/2 (DN 65): Maximum span, 108 inches (2700 mm); minimum rod size, 3/8 inch (9.5 mm).
8. All sizes, provide supports within 12 inches of all changes in direction.

D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.

3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures and per equipment manufacturers instructions:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Verify that compressor oil level is correct.
2. Open compressor suction and discharge valves.
3. Open refrigerant valves except bypass valves that are used for other purposes.
4. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

SECTION 23 25 00 - HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following HVAC water-treatment systems:

1. Bypass chemical-feed equipment and controls.
2. Chemical treatment test equipment.
3. HVAC water-treatment chemicals.

1.3 DEFINITIONS

A. EEPROM: Electrically erasable, programmable read-only memory.

B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

C. RO: Reverse osmosis.

D. TDS: Total dissolved solids.

E. UV: Ultraviolet.

1.4 PERFORMANCE REQUIREMENTS

A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.

B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

C. Closed hydronic systems, including chilled water systems, shall have the following water qualities:

1. pH: Maintain a value within 9.0 to 10.5 .
2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
3. Boron: Maintain a value within 100 to 200 ppm.
4. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.

5. Soluble Copper: Maintain a maximum value of 0.20 ppm.
6. TDS: Maintain a maximum value of 10 ppm.
7. Ammonia: Maintain a maximum value of 20 ppm.
8. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
9. Microbiological Limits:

    a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
    b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
    c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
    d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
    e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

D. Steam Boiler and Steam Condensate:

1. Steam Condensate:

    a. pH: Maintain a value within 7.8 to 8.4 .
    b. Total Alkalinity: Maintain a value within 5 to 50 ppm.
    c. Chemical Oxygen Demand: Maintain a maximum value of 15 Soluble Copper: Maintain a maximum value of 0.20 ppm.
    d. TDS: Maintain a maximum value of 10 ppm.
    e. Ammonia: Maintain a maximum value of 20 ppm.
    f. Total Hardness: Maintain a maximum value of 2 ppm.

2. Steam boiler operating at more than 15 psig shall have the following water qualities:

    a. "OH" Alkalinity: 200 to 400 ppm.
    b. TDS: Maintain a value within 600 to 1200 ppm to maximum 30 times RO water TDS.

1.5 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for the following products:

1. Bypass feeders.
2. Chemical material safety data sheets.

B. Field quality-control test reports.

C. Other Informational Submittals:

1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.
2. Water Analysis: Illustrate water quality available at Project site.
3. Passivation Confirmation Report: Verify passivation of galvanized-steel surfaces, and confirm this observation in a letter to Architect.

1.6 QUALITY ASSURANCE

A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 MAINTENANCE SERVICE

A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for chilled-water piping, steam and condensate piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:

1. Initial water analysis and HVAC water-treatment recommendations.
2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
3. Periodic field service and consultation.
4. Customer report charts and log sheets.
5. Laboratory technical analysis.
6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

1. Ampion Corp.
2. Anderson Chemical Co, Inc.
3. Aqua-Chem, Inc.;
4. Barclay Chemical Co.; Water Management, Inc.
5. Boland Trane Services
6. GE Betz.
7. GE Osmonics.
8. H-O-H Chemicals, Inc.
9. Metro Group. Inc. (The); Metropolitan Refining Div.
10. ONDEO Nalco Company.
11. Watcon, Inc.

2.2 MANUAL CHEMICAL-FEED EQUIPMENT

A. Bypass Feeders: Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch fill opening in the top, and NPS 3/4 bottom inlet and top side outlet. Quarter turn or threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel.

1. Capacity: 12 gal..
2. Minimum Working Pressure: 175 psig.

2.3 CHEMICALS

A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality specified in Part 1 "Performance Requirements" Article.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 INSTALLATION

A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.

B. Bypass Feeders: Install in closed hydronic systems, and equipped with the following:

1. Install bypass feeder in a bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
2. Install water meter in makeup water supply.
3. Install test-coupon assembly in bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
4. Install a gate or full-port ball isolation valves on inlet, outlet, and drain below feeder inlet.
5. Install a swing check on inlet after the isolation valve.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Dielectric fittings are specified in Division 23 Section "Common Work Results for HVAC."

D. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Division 23 Section "General-Duty Valves for HVAC Piping."

E. Install backflow preventers required in makeup water connections to potable-water systems.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
7. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
8. Repair leaks and defects with new materials and retest piping until no leaks exist.

D. Remove and replace malfunctioning units and retest as specified above.

E. At six-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" Article.

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F. Comply with ASTM D 3370 and with the following standards:

1. Silica: ASTM D 859.
2. Steam System: ASTM D 1066.
3. Acidity and Alkalinity: ASTM D 1067.
4. Iron: ASTM D 1068.
5. Water Hardness: ASTM D 1126.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment. Refer to Division 01 Section "Demonstration and Training."

B. Training: Provide a "how-to-use" self-contained breathing apparatus video that details exact operating procedures of equipment.

END OF SECTION

SECTION 23 31 13 – METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.3 SUBMITTALS

A. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.

B. Shop Drawings:

1. Building information modeling (BIM) process shall be performed at an LOD-400 level as part of developing the shop drawing and includes but is not limited to creating model of 3D objects in Revit or AutoCAD based program, modeling objects accurately based on

actual cut lengths and with access and clearance requirements incorporated, and coordinating with all MEP trades.

2. Deliverables to engineer: Detail, 1/4 inch equals 1 foot scale drawings.

C. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Provide Drive Slip or Hemmed “S” Slip or approved equal.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Provide Drive Slip or Hemmed “S” Slip or approved equal.

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. McGill AirFlow LLC.
b. SEMCO Incorporated.
c. Sheet Metal Connectors, Inc.
d. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger Than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 (Z180).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2. Maximum Thermal Conductivity:

   a. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F (0.033 W/m x K) at 75 deg F (24 deg C) mean temperature.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

   a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.

6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.7 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Kinetics Noise Control.
3. Mason Industries.
4. TOLCO; a brand of NIBCO INC.
5. Unistrut Corporation; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A 603, galvanized or ASTM A 492, stainless-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors installed and/or stored on site from moisture, construction debris and dust, and other foreign materials.

1. Cover and seal open ends of ducts with plastic wrap and duct tape.
2. Turn off ventilation system and protect duct interiors from dust infiltration during dust producing activities (e.g. demolition, drywall installation, finishing).
3. At the end of each workday, cover and seal open ends or openings of installed ducts with plastic wrap and duct tape.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

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3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with ASCE/SEI 7.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

A. Paint exterior of metal ducts that are visible. Paint materials and application requirements are specified in Division 09 painting Sections.

3.8 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

3.9 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.

B. Supply and Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

    a. Pressure Class: Positive 2-inch wg (500 Pa).
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Constant-Volume Air-Handling Units:

    a. Pressure Class: Positive 2-inch wg (500 Pa).
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive 2-inch wg (500 Pa).
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 12.

d. SMACNA Leakage Class for Round and Flat Oval: 12.

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg (500 Pa).
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg (500 Pa).
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 1-inch wg (250 Pa).
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.

2. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.

b. Not Exposed to Airstream: Match duct material.

F. Liner:

1. Supply Air Ducts: Fibrous glass, Type II, 1-1/2 inches (38 mm) thick.
2. Return Air Ducts: Fibrous glass, Type II, 1-1/2 inches (38 mm) thick.
3. Supply Fan Plenums: Fibrous glass, Type II, 1-1/2 inches (38 mm) thick.
4. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 2 inches (51 mm) thick.
5. Transfer Ducts: Fibrous glass, Type II, 1-1/2 inches (38 mm) thick.
6. Supply, Return and Energy Recovery Ducts Exposed on Roof: Fibrous glass, Type II, 2 inches thick.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

   a. Velocity 1000 fpm (5 m/s) or Lower:

      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      2) Mitered Type RE 4 without vanes.

   b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):

      1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

   c. Velocity 1500 fpm (7.6 m/s) or Higher:

      1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
   c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

      1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Spot welded seam.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections" and details provided on drawings.

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: 45 degree Lead-In,Low-loss.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and details provided on drawings.

a. All shall be 45-degree lateral.

END OF SECTION

SECTION 23 33 00 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Combination fire and smoke dampers.
4. Corridor dampers.
5. Flange connectors.
6. Turning vanes.
7. Remote damper operators.
8. Duct-mounted access doors.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

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PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and No. 3 finish for exposed ducts.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ventfabrics, Ventlok
2. Duro Dyne Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff; a division of PCI Industries, Inc.
6. Ruskin Company.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 1-inch wg.

E. Frame: 0.052-inch-thick, galvanized sheet steel, with welded corners and mounting flange.

F. Blades: Multiple single-piece blades, maximum 6-inch width, [0.025-inch- thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Vinyl foam.

I. Blade Axles:

1. Material: Galvanized steel or Stainless steel.
2. Diameter: 0.20 inch.

J. Return Spring: Adjustable tension.

K. Bearings: Steel ball or Synthetic pivot bushings.

L. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.
    a. Sleeve Thickness: 20-gage minimum.
    b. Sleeve Length: 6 inches minimum.
6. Screen Mounting: Rear mounted.
7. Screen Material: Galvanized steel or Aluminum.
8. Screen Type: Bird.
9. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
    a. Ventfabrics, Ventlok.
    b. McGill AirFlow LLC.
    c. METALAIRE, Inc.
    d. Nailor Industries Inc.
    e. Pottorff; a division of PCI Industries, Inc.
    f. Ruskin Company.
    g. Duro Dyne Inc.
2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:

a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel or Stainless steel.
7. Bearings:

a. Molded synthetic or Stainless-steel sleeve.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 1-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, spring loaded, serrated die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Ruskin Company.

B. Type: Static and dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum [2000-fpm] velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Multiple-blade type; fabricated with roll-formed 5”x16 GA., 0.0625-inch-thick galvanized steel; with mitered and interlocking corners.

F. Heat-Responsive Device: Electric resettable link and switch package, factory installed, 165 °F rated.

G. Smoke Detector: Refer to Division 28.

H. Blades: True airfoil shaped, single piece 14 ga. or double skin 16 and 20 ga. galvanized steel. Opposed action, maximum 6 inches width. Self-lubricating stainless steel sleeve bearings turning in extruded hole in frame.

I. Leakage: Class II.

J. Linkage: Concealed in frame.

K. Axles: Minimum ½ inch diameter plated steel, hex shaped, mechanically attached to blade.

L. Seals:
1. Blade: Inflatable silicone fiberglass material to maintain smoke leakage rating to a minimum of 450°F and galvanized steel for flame seal to 1,900°F. Mechanically attached to blade edge (glue-on or grip type seals are not acceptable).
2. Jamb: Stainless steel, flexible metal compression type.

M. Rated pressure and velocity to exceed design airflow conditions.

N. Mounting Sleeve: Factory-installed, minimum 20ga., galvanized sheet steel; length to suit wall or floor application with factory-applied silicone calking.

O. Actuator: Electric 120 volt, 60 HZ, two-position fail-close action.

P. Accessories:

1. Two position indicator switches linked directly to damper blade to remotely indicate damper blade position.

2.5 CORRIDOR DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Nailor Industries Inc.
4. Ruskin Company.

B. General Requirements: Label combination fire and smoke dampers according to UL 555 for 1-hour rating and UL 555S Class 1 by an NRTL.

C. Leakage Class: Class II.

D. Heat-Responsive Device: Electric resettable link and switch package, factory installed, 165°F rated.

E. Frame: Multiple-blade type; fabricated with roll-formed, 5”x16 ga, 0.0625-inch-thick galvanized steel; with mitered and interlocking corners.

F. Blades: True airfoil shaped, single piece 14 ga. or double skin 16 and 20 ga. galvanized steel. Opposed action, maximum 6 inches width. Self-lubricating stainless steel sleeve bearings turning in extruded hole in frame.

G. Linkage: Concealed in frame.

H. Axles: Minimum ½ inch diameter plated steel, hex shaped, mechanically attached to blade.

I. Seals:
1. Blade: Inflatable silicone fiberglass material to maintain smoke leakage rating to a minimum of 450°F and galvanized steel for flame seal to 1,900°F. Mechanically attached to blade edge (glue-on or grip type seals are not acceptable).
2. Jamb: Stainless steel, flexible metal compression type.

J. Mounting Sleeve: Factory-installed, minimum 20 ga, galvanized sheet steel; length to suit wall or ceiling application with factory-applied silicone calking.

K. Actuator: Electric 120 volt, 60 HZ, Two-position fail-close action.

2.6 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.7 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.

3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
6. Aero Dyne HEP

B. Manufactured Turning Vanes for Metal Ducts: Double wall, hollow metal, airfoil shape blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

D. Vane Construction: Double wall.

2.8 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pottorff; a division of PCI Industries, Inc.
2. Ventfabrics, Inc.
3. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Brass.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed, 2 inches deep.

F. Wall-Box Cover-Plate Material: Stainless steel.

2.9 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Flexmaster U.S.A., Inc.
5. Greenheck Fan Corporation.
6. McGill AirFlow LLC.
7. Nailor Industries Inc.
8. Pottorff; a division of PCI Industries, Inc.

9. Ventfabrics, Inc.
10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:

   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 10-inch wg.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.10 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.11 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Minimum Tensile Strength: 500 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.12 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
4. J.P. Lamborn Co.

B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.
4. Insulation R-Value: R-8.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.13 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, outside-air and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
2. Control devices requiring inspection.
3. Kitchen exhaust ductwork.
4. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Connect terminal units to supply ducts directly.

O. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

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P. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

Q. Install duct test holes where required for testing and balancing purposes.

R. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 23 34 23 – HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Utility set fans.
2. Centrifugal roof ventilators.
3. Upblast propeller roof exhaust fans.
4. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations as detailed on plans

PART 2 - PRODUCTS

2.1 IN-LINE CENTRIFUGAL FANS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Greenheck
2. Loren Cook Company.
3. Carnes Company HVAC.
4. Penn Ventilation.

B. Description: In-line, direct-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

D. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

E. Direct Drive Motors:

1. Open type motor enclosure with DC electronic commutation type motor (ECM) specifically designed for fan applications.
2. Motors are permanently lubricated heavy duty ball bearing type to match with the fan load.
3. Motor speed controllable down to 20% of full speed, controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal
4. Motor shall be a minimum 85% efficient at all speeds.

F. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

G. Accessories:

1. Companion Flanges: For inlet and outlet duct connections.

2.2 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.3 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using elastomeric mounts, spring isolators, or restrained spring isolators as indicated on plans, having a static deflection of 1 inch. Vibration- and seismic-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Support suspended units from structure using threaded steel rods and elastomeric hangers or spring hangers as indicated on plans having a static deflection of 1 inch. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION

SECTION 23 36 00 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bypass, single-duct air terminal units.
2. Dual-duct air terminal units.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

PART 2 - PRODUCTS

2.1 BYPASS, SINGLE-DUCT AIR TERMINAL UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Carrier Corporation.
2. Titus.
3. Trane; a business of American Standard Companies.

B. Configuration: Diverting-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.034-inch steel, single wall.

1. Casing Lining: Adhesive attached, 1/2-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

    a. Cover liner with nonporous foil.
    b. Cover liner with nonporous foil and perforated metal.
2. Air Inlet: Round stub connection for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to diverting damper and other parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

D. Diverter Assembly: Galvanized-steel gate, with polyethylene linear bearings.

E. Direct Digital Controls: Bidirectional damper operator and microprocessor-based thermostat. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation and Control for HVAC" and shall have the following features:

1. Damper Actuator: 24 V, powered closed, powered open.

2.2 DUAL-DUCT AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Carrier Corporation.
2. Titus.
3. Trane; a business of American Standard Companies.

B. Configuration: Two volume dampers inside unit casing with mixing attenuator section and control components inside a protective metal shroud.

C. Casing: 0.03125-inch steel, single wall.

1. Casing Lining: Adhesive attached, 1/2-inch-thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

    a. Cover liner with nonporous foil.

2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 3 percent of nominal airflow at 3-inch wg inlet static pressure.

E. Direct Digital Controls: Bidirectional damper operators and microprocessor-based controller and room sensor. Control devices shall be compatible with controls specified in Division 23 Section "Instrumentation and Control for HVAC" and shall have the following features:

1. Damper Actuators: 24 V, powered closed, spring return open.
2. Terminal Unit Controller: Pressure-independent, constant-volume controller with electronic airflow transducers factory calibrated to minimum and maximum air volumes, and having the following features:

a. Occupied and unoccupied operating mode.
b. Remote reset of airflow or temperature set points.
c. Adjusting and monitoring with portable terminal.
d. Communication with temperature-control system specified in Division 23 Section "Instrumentation and Control for HVAC."

3. Room Sensor: Wall mounted with temperature set-point adjustment and access for connection of portable operator terminal.

F. Control Sequence:

1. Modulate cold-air damper to maintain room temperature.
2. Modulate warm-air damper to maintain constant airflow.

2.3 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Steel Cables: Galvanized steel complying with ASTM A 603.

C. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

D. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

E. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test assembled air terminal units according to ARI 880.

1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, and ARI certification seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install wall-mounted thermostats.

3.2 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

A. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."

B. Make connections to air terminal units with flexible connectors complying with requirements in Division 23 Section "Air Duct Accessories."

3.4 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
3. Verify that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified.

END OF SECTION

SECTION 23 38 13 - COMMERCIAL-KITCHEN HOODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Type I commercial kitchen hoods.

1.3 DEFINITIONS

A. Listed Hood: A hood, factory fabricated and tested for compliance with UL 710 by a testing agency acceptable to authorities having jurisdiction.

B. Standard Hood: A hood, usually field fabricated, that complies with design, construction, and performance criteria of applicable national and local codes.

C. Type I Hood: A hood designed for grease exhaust applications.

D. Type II Hood: A hood designed for heat and steam removal and for other nongrease applications.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Listed hoods.
2. Filters/baffles.
3. Fire-suppression systems.
4. Lighting fixtures.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate equipment layout and installation with adjacent Work, including lighting fixtures, HVAC equipment, plumbing, and fire-suppression system components.

PART 2 - PRODUCTS

2.1 HOOD MATERIALS

A. Stainless-Steel Sheet: ASTM A 666, Type 430.

1. Minimum Thickness: 0.050 inch.
2. Finish: Comply with SSINA's "Finishes for Stainless Steel" for recommendations for applying and designating finishes.

a. Finish shall be free from tool and die marks and stretch lines and shall have uniform, directionally textured, polished finish indicated, free of cross scratches. Grain shall run with long dimension of each piece.

3. Concealed Stainless-Steel Surfaces: ASTM A 480/A 480M, No. 2B finish (bright, cold-rolled, unpolished finish).
4. Exposed Surfaces: ASTM A 480/A 480M, No. 4 finish (directional satin).
5. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Carbon-Steel Sheets: ASTM A 1008/A 1008M, cold-rolled sheets; commercial quality; with oiled, exposed matte finish.

1. Minimum Thickness: 0.0478 inch.

C. Galvanized-Steel Sheet: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation.

1. Minimum Thickness: 0.052 inch.

D. Zinc-Coated Steel Shapes: ASTM A 36/A 36M, zinc coated according to ASTM A 123/A 123M requirements.

E. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Elastomeric sealant shall be NSF certified for commercial kitchen hood application. Sealants, when cured and washed, shall comply with requirements in 21 CFR, Section 177.2600, for use in areas that come in contact with food.

1. Color: As selected by Architect from manufacturer's full range.
2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.

F. Sound Dampening: NSF-certified, nonabsorbent, hard-drying, sound-deadening compound for permanent adhesion to metal in minimum 1/8-inch thickness that does not chip, flake, or blister.

G. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds, and that passes testing according to UL 710.

2.2 GENERAL HOOD FABRICATION REQUIREMENTS

A. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Make ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.

1. Welded Butt Joints: Full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and flush.
4. Coat concealed stainless-steel welded joints with metallic-based paint to prevent corrosion.
5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780/A 780M.

B. For metal butt joints, comply with SMACNA's "Kitchen Equipment Fabrication Guidelines."

C. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.

D. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.

E. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.

F. In food zones, as defined in NSF, fabricate surfaces free from exposed fasteners.

G. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.

H. Fabricate pipe slots on equipment with turned-up edges sized to accommodate service and utility lines and mechanical connections.

I. Fabricate enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets, unless otherwise indicated.

J. Fabricate seismic restraints according to SMACNA's "Kitchen Equipment Fabrication Guidelines," Appendix 1, "Guidelines for Seismic Restraints of Kitchen Equipment."

K. Fabricate equipment edges and backsplashes according to SMACNA's "Kitchen Equipment Fabrication Guidelines."

L. Fabricate enclosure panels to ceiling and wall as follows:

1. Fabricate panels on three side with same material as hood, and extend from ceiling to top of hood canopy and from canopy to wall.
2. Wall Offset Spacer: Minimum of 3 inches.
3. Wall Shelves and Overshelves: Fabricate according to SMACNA's "Kitchen Equipment Fabrication Guidelines," with minimum 0.0625-inch-thick, stainless-steel shelf tops.

2.3 TYPE I EXHAUST HOOD FABRICATION

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Greenheck.
2. Captive-Aire Systems.
3. Halton Company.

B. Weld all joints exposed to grease with continuous welds, and make filters/baffles or grease extractors and makeup air diffusers easily accessible for cleaning.

1. Fabricate hoods according to NSF 2, "Food Equipment."
2. Hoods shall be listed and labeled, according to UL 710, by a testing agency acceptable to authorities having jurisdiction.
3. Hoods shall be designed, fabricated, and installed according to NFPA 96.
4. Include access panels as required for access to fire dampers and fusible links.
5. Duct Collars: Minimum 0.0598-inch-thick steel at least 3 inches long, continuously welded to top of hood and at corners.

C. Hood Configuration: Exhaust and makeup air.

1. Makeup air shall be introduced through laminar-flow-type, perforated metal panels on front of hood canopy.

D. Hood Style: Wall-mounted canopy.

E. Filters/Baffles: Removable, stainless-steel, with spring-loaded fastening. Fabricate stainless steel for filter frame and removable collection cup and pitched trough. Exposed surfaces shall be pitched to drain to collection cup. Filters/baffles shall be tested according to UL 1046, "Grease Filters for Exhaust Ducts," by an NRTL acceptable to authorities having jurisdiction.

F. Lighting Fixtures: Surface-mounted, incandescent fixtures and lamps with lenses sealed vaportight. Wiring shall be installed in conduit on hood exterior. Number and location of fixtures shall provide a minimum of 43 fc at 30 inches above finished floor.

1. Light switches shall be mounted in hood control panel.
2. Lighting Fixtures: Incandescent complying with UL 1598.

G. Comply with requirements in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls " for hood controls.

H. Hood Controls: Wall-mounting control cabinet, fabricated of stainless steel.

1. Exhaust Fan: On-off switches shall start and stop the exhaust fan. Interlock exhaust fan with makeup air supply fan to operate simultaneously. Interlock exhaust fan with fire-suppression system to operate fan(s) during fire-suppression-agent release and to remain in operation until manually stopped. Include red pilot light to indicate fan operation. Motor starters shall comply with Division 26 Section "Enclosed Controllers."

I. Capacities and Characteristics: As scheduled and detailed on plans.

2.4 WET-CHEMICAL FIRE-SUPPRESSION SYSTEM

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ansul Incorporated; a Tyco International Ltd. Company.
2. Badger Fire Protection.
3. Kidde Fire Systems.
4. Pyro Chem.

B. Description: Engineered distribution piping designed for automatic detection and release or manual release of fire-suppression agent by hood operator. Fire-suppression system shall be listed and labeled for complying with NFPA 17A, "Wet Chemical Extinguishing Systems," NFPA 96 2011 Edition and UL300 standard 2005 by a qualified testing agency acceptable to authorities having jurisdiction.

1. Steel Pipe, NPS 2 and Smaller: ASTM A 53/A 53M, Type S, Grade A, Schedule 40, plain ends.
2. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
3. Piping, fusible links and release mechanism, tank containing the suppression agent, and controls shall be factory installed. Controls shall be in stainless-steel control cabinet mounted on hood. Furnish manual pull station for wall mounting. Exposed piping shall be covered with chrome-plated aluminum tubing. Exposed fittings shall be chrome plated.
4. Liquid Extinguishing Agent: Noncorrosive, low-pH liquid.
5. Furnish electric-operated gas shutoff valve with clearly marked open and closed indicator for field installation.
6. Fire-suppression system controls shall be integrated with controls for fans, lights, and fuel supply and located in a single cabinet for each group of hoods immediately adjacent.
7. Wiring shall have color-coded, numbered terminal blocks and grounding bar. Spare terminals for fire alarm, optional wiring to start fan with fire alarm, red pilot light to indicate fan operation, and control switches shall all be factory wired in control cabinet with relays or starters. Include spare terminals for fire alarm, and wiring to start fan with fire alarm.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Complete field assembly of hoods where required.

1. Make closed butt and contact joints that do not require filler.
2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in Part 2 "General Hood Fabrication Requirements" Article.

B. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, filters/baffles, grease extractor, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.

C. Make cutouts in hoods where required to run service lines and to make final connections, and seal openings according to UL 1978.

D. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.

E. Install hoods to operate free from vibration.

F. Install seismic restraints according to SMACNA's "Kitchen Equipment Fabrication Guidelines," Appendix 1, "Guidelines for Seismic Restraints of Kitchen Equipment."

G. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 24 inches o.c. maximum.

H. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.

I. Install lamps, with maximum recommended wattage, in equipment with integral lighting.

J. Set initial temperatures, and calibrate sensors.

K. Set field-adjustable switches.

3.3 CONNECTIONS

A. Connect ducts according to requirements in Division 23 Section "Air Duct Accessories." Install flexible connectors on makeup air supply duct. Weld exhaust-duct connections with continuous liquid tight joint.

B. Install fire-suppression piping for remote-mounted suppression systems according to UL300 and NFPA 17A, "Wet Chemical Extinguishing Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Test each equipment item for proper operation. Repair or replace equipment that is defective, including units that operate below required capacity or that operate with excessive noise or vibration.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Test water, drain, gas, and liquid-carrying components for leaks. Repair or replace leaking components.
4. Perform hood performance tests required by authorities having jurisdiction.
5. Perform fire-suppression system performance tests required by authorities having jurisdiction.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial kitchen hoods. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 23 51 00 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section specifies double wall metal vents and accessories for categories II, III and IV gas fired appliances.
B. Related Sections include the following:
   1. Division 23 Section “Condensing Boilers”
   2. Division 23 Section “Draft Control Devices”

1.3 SUBMITTALS

A. Product Data: Submits product data including materials, dimensions, weights, and accessories.

C. Shop Drawings: Submits detailed layout shop drawings, plans and elevations, including required clearances, assembly and installation instructions, and support of components.

D. Quality Control Submittals:

1 Certificates: When applicable - Submit certificates of materials compliance with specified ASTM, UL, and ASHRAE requirements.

2 Certificates: When applicable - Submit complete engineering report certifying that stacks meet the design wind and seismic loads.

1.4 QUALITY ASSURANCE

A. Welder’s Qualifications: All welders shall be certified in accordance with AWS Standard D9.1, Specifications for Welding Sheet Metal.

B. Codes and Standards:

- NFPA: Comply with NFPA 211 “Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances.”
- UL: Comply with applicable portions of UL safety standards; provide products which have been UL listed and labelled.
- SMACNA: Comply with SMACNA Low Pressure Duct Standards for fabricated breeching and smoke pipe.
- AWS: Comply with AWS Structural Welding Code for welder’s qualifications, welding details, and workmanship standards.
- ASHRAE: Comply with the ASHRAE Equipment Handbook for Chimney, Gas Vent, and Fireplace Systems, material requirements and design criteria.

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PART 2 - PRODUCTS

2.1 PRODUCTS

A. Double wall metal vents.

B. All steel, positive pressure, double wall stack:

1) Manufacturers: subject to compliance with requirements, provide all steel, positive pressure double wall vents of the following type:

a) Cleaver Brooks Exhaust Solutions, model CBHLA

b) Heat-Fab

c) Duravent

C. The factory built breeching system shall be made in accordance with NFPA 211. This stack system shall be designed and installed to be gas tight. It shall be UL 1738 Listed to withstand up to 15" w.c. positive pressures. This breeching system shall be designed to compensate for all flue gas induced thermal expansions. Air space insulation between inner and outer pipe shall be 1 inch thick. Clearances to combustible materials shall be per installation instructions.

D. The joint assembly shall be a male/female slip-type jointing with flange to flange and V-band assembly. An internal sleeve serves for readily alignment as well as long term joint seal protection from condensate, water and flue gas temperature. Non-slip type joints are not acceptable.

E. The double wall stack has an inner gas carrying pipe of 24 gauge stainless steel as per UL1738. The outer jacket shall be 24 gauge 304 stainless steel. The materials and construction of the modular sections and accessories shall be as specified by the terms of the product’s UL Listing.

F. The entire stack system from each boiler to the termination, including accessories, shall be from one manufacturer.

G. The breeching and stack shall be warranted against functional failure due to defects in material and manufacturer’s workmanship for a period of 15 years from the date of delivery.

H. Drawings showing the actual layout and drawn to scale shall be provided by the manufacturer. The system shall be installed as designed by the manufacturer and in accordance with the terms of the manufacturer’s 15 year warranty and in conjunction with sound engineering practice.

I. The inner diameter for breeching and stack shall be verified by the manufacturer’s computations. The computation shall be technically sound, shall follow ASHRAE calculation methods and incorporate the specific flow characteristics of the inner pipe.

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J. Technical services supports. The factory built modular stack system shall be furnished by a vendor organization which assures design, installation and service coordination and provides in-warranty and post warranty unified responsibility for owner.

PART 3 - EXECUTION

3.1 INSTALLATION OF DOUBLE WALL CONNECTORS, BREECHINGS, AND VENTS

A. The stack system shall be installed according to the manufacturer's installation instructions. The joining of pipe sections must be made using the assembly band, the finishing band and the appropriate sealing material. Roof penetrations shall be suitable for a combustible roof and shall be according to the manufacturer's detail drawings and installation instructions.

B. When installed according to the manufacturer's installation instructions the stack and its supporting system shall resist side loads at least 1.5 times the weight per foot of piping.

END OF THE SECTION

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SECTION 23 52 39 - BOILER SKID PACKAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes packaged, factory-fabricated and -assembled boilers, trim, and accessories for generating steam with the following configurations and burners:

1. Vertical tubeless boiler.
2. Gas burner.
3. Boiler return system.
4. Condensate receiver.
5. Blowdown separator.
6. Pumps.
7. Control panel.

1.3 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.

1. Design calculations and vibration isolation base details of boiler and pumps to skid, signed and sealed by a qualified professional engineer.

a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

b. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and equipment mounting frames.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Source quality-control test reports.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For boilers, components, and accessories to include in emergency, operation, and maintenance manuals.

F. Warranty: Special warranty specified in this Section.

G. Other Informational Submittals:

1. ASME Stamp Certification and Report: Submit "A," "S," or "PP" stamp certificate of authorization, as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.

2. Startup service reports.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.

C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

D. UL Compliance: Test Boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

1.5 COORDINATION

A. Coordinate size and location of concrete house keeping pads.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace front- and rear-door refractories and heat exchangers of boilers that fail in materials or workmanship within specified warranty period.

1. Pressure vessel shall be guaranteed against defects for 5 years from date of startup by factory-authorized personnel.

2. Receiver shall have 10 year warranty from date of startup by factory-authorized personnel.

3. Pumps shall have 5 year warranty from date of startup by factory-authorized personnel.

4. All parts not covered by the above warranties shall carry a 1 year warranty from date of startup, or 18 months from date of shipment, whichever occurs first. This shall include all electrical and burner components

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide Cleaver Brooks or a comparable product by one of the following:

1. Cleaver-Brooks, Inc.

2. Hurst Boiler & Welding Company, Inc.

3. Fulton Boiler Works, Inc.

4. Patterson-Kelley.

2.2 MANUFACTURED UNITS

A. Description: Factory-fabricated, -assembled, and -tested, vertical, fire-tube boilers with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket, flue-gas vent, water supply and return connections, and controls.

B. PRESSURE VESSEL

The boiler shell must be constructed in accordance with the ASME Code, Section I for high-pressure steam. The boiler shall have a Maximum Allowable Working Pressure of 150 psig. The vessel must be subjected to the required inspections of the Code conducted by an independent third-party inspector. A signed inspection sheet shall be provided to the purchaser and the appropriate ASME symbol shall be affixed or stamped onto the boiler.

1. Boiler shall accommodate a side-mounted burner to provide maximum available steam space with minimum 2.3 cubic feet of steam volume per 10HP and minimum 2 square feet of steam disengaging area per 10HP.

2. Boiler shall be mounted on base rails suitable for transporting by fork lift.

3. Burner housing shall be removable to allow fireside inspection.

4. To facilitate waterside inspection, 2 handholes shall be provided at bottom mud drum.

5. An observation port for flame inspection shall be provided.

6. The boiler insulation system shall have no refractory and shall consist of a high-density insulation system which shall be covered with a painted sheet metal jacket. This jacket and insulation design shall permit field removal and reattachment if necessary for inspection, etc.

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7. All exposed exterior surfaces of the boiler and base frame shall be factory painted.

8. Exhaust vent shall be located at the rear of the boiler and shall be a slip connection. Stack support shall be by means other than the boiler connection.

C. BOILER SHELL TAPPINGS/OPENINGS

1. The following boiler vessel tappings/openings shall be furnished:

   a. Steam supply by NPT connection for high-pressure steam or flanged for low pressure steam.

   b. Bottom blowdown/drain.

   c. Feedwater Make-up.

   d. Surface blowoff.

   e. Chemical Feed.

   f. High Water Level Overflow Drain to discharge water in the boiler if water level reaches an unacceptable level.

   g. Safety Relief Valve(s).

2. STEAM BOILER TRIM (All piping and devices per ASME CSD-1)

3. Water Column

   a. A water column shall be furnished complete with gauge glass and water column blowdown valve.

      1) Feedwater Pump Control – shall be integral with the water column via probe control device and electronics for on/off pump operation.

      2) Low Water Cutoff – shall be integral with the water column via probe control device and solid state electronics mounted and wired in the control panel.

4. An Auxiliary Low Water Cutoff shall be provided. It shall be located on the top centerline of the boiler using an internal probe and shall be of the manual reset design.

5. For safety steam pressure lockout a high limit pressure control, manual reset shall be provided. The device shall be mercury free.

6. To provide steam demand tracking a steam pressure transmitter shall be provided that provides an input signal for burner positioning in accordance to steam demand.

7. A 3" Steam Pressure Gauge shall be piped onto the trim piping, including an inspectors test cock.

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8. In accordance with the A.S.M.E. Code an approved A.S.M.E. rated and stamped safety valve shall be provided and set at [15 or 150]#.

D. BURNER AND BURNER CONTROLS

1. Mode of Operation - To minimize short cycling and provide highest efficiency the burner for the specified boiler shall be of the electronic modulation with a turndown ratio of 5:1 for sizes of 40 to 50 horsepower, and 4:1 for sizes 30 horsepower and below (Natural Gas). On/off or two-stage burner operation shall not be accepted.

2. The burner assembly shall be enclosed in a NEMA 4x type enclosure. A removable cover shall be provided to gain access to the burner and controls. Burner enclosure is to be removable without tools for ease of access to safety switches.

3. Design - The burner design shall be of the linkage-less self-regulating venturi premix technology wherein the fuel and air are mixed in the combustion air fan housing assembly prior to entering the burner canister. Separately driven linkage or servo motor driven fuel valves shall not be permitted.

4. Fan housing shall utilize non-sparking material and shall be approved for premix operation.

   a. The combustion air fan shall be driven by a variable speed motor which shall react to output demand requirements via the demand control providing true linear PID modulation. Motor shall be a high efficiency ECM type with integral variable speed drive electronics. Continuous speed synchronous motors will not be acceptable

   b. The burner shall be <70 dBA without the need for a silencer.

   c. The burner shall include provision for direct vent combustion air.

5. Ignition of the fuel shall be of the direct spark design; separate pilot gas train is not required. Dual ignition electrodes shall be used for the spark generated from the panel mounted ignition transformer.

6. UV scanner or flame rod shall be used for flame supervision.

7. The burner shall be integral to the boiler and not from a third party. Combustion shall take place on the surface of the burner canister. The canister shall be constructed of Fecralloy material and stainless steel. The burner shall be low emission:<20 ppm NOx and <20 ppm CO throughout the modulation range of the boiler. External flue gas recirculation shall not be allowed.

8. Combustion Air Proving Switch shall be provided to prove, prior to modulation, that the combustion air blower is operating properly.

9. Air Filter - shall be fitted to the intake air venturi to filter the incoming air supply when using boiler room air. The air filter shall be designed to be easily cleaned and/or replaced.

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10. Fuel - The burner shall be designed for operation with natural gas or LP gas. Gas Train, shall be located at the front of the burner and along the left side of the boiler. In accordance with UL/cUL and ASME CSD-1, the following components shall be furnished:

    a. Single body dual solenoid safety shutoff valve incorporating the following:

        1) The valve shall be a 1:1 ratio valve with an integral trim regulator and shall operate in relation to the fan speed. An air sensing line shall be connected from the air inlet venturi (mounted to the fan motor) and to the gas valve for control of gas input.

    b. Manual fuel shutoff valve – shall be located downstream of the gas valve and used for CSD-1 leak testing.

    c. Gas Pressure Interlocks - one shall be provided for sensing high gas pressure and one provided to sense low gas pressure. Each control shall be of the manual reset type.

    d. Gas Pressure Regulator - shall be provided upstream of the gas valve to provide regulated pressure to the gas train from the gas supply. This regulator shall be suitable for a maximum of 1 psig gas pressure. If gas pressure exceeds 1 psig, a gas pressure relief valve shall be furnished and upstream pressure regulator that is of the full lockup type.

    e. Manual Shutoff Valves - shall be provided upstream of the gas regulator to manually close off the gas supply when servicing the gas train or isolating the boiler. A shutoff valve shall be provided at the burner for tightness checking of the gas valve.

11. Flame Safety

    a. Flame Sensing shall be accomplished with UV sensing or a flame rod mounted in the burner mounting plate, designed for easy removal for inspection or replacement.

E. CONTROL PANEL

1. A NEMA 4x type enclosure is furnished and located at the front of the boiler to house the following components:

2. Solid state circuit boards for water level controls alarm, and parameterization.

3. Controller shall provide for both flame safeguard and boiler control and shall perform the following functions:

    a. Flame supervision, burner sequencing, modulation, control, and operating limit control.

    b. Color touchscreen display/operator interface with English text annunciation.

c. Safety Shutdown with display of lockout.

d. Modulating control of the variable speed fan for fuel/air input relative to load requirements.

e. Gas pressure supervision, high and low.

f. Combustion Air Proving Supervision.

g. The steam pressure and set-point pressure shall be displayed at all times on color touchscreen operator interface. Modulation Output shall be continuous PID control via PWM or 4 –20 mA current.

4. All parameter input control set-points shall be factory configured with jobsite conditions configured at the time of initial jobsite operation.

5. Demand switch (boiler demand and burner on-off).

6. Indicator lights shall be standard for General Alarm (including flame failure), Low Water, Load Demand, and Fuel Valve energized. Alarm horn, High Water and other functions are optional.

7. Provide convenience terminals for control interface wiring, customer connections, and connections for incoming power.

8. Install solid state circuit boards for water level controls.

F. PERFORMANCE

1. The boiler shall be cULus Listed unitary boiler package to UL 795 and to CSA/CAN1-3.1-77.

2. Emissions - NOx emissions shall be less than 20 PPM corrected to 3% O2 and less than 20 PPM CO over the operating range of the burner turndown. If emissions exceed this level, the boiler manufacturer shall correct at their expense until this level is achieved on a repeatable basis.

3. Noise – Sound shall not exceed 70 dBA at high fire when measured 3 feet in front of the burner.

4. Radiation losses shall be less than 0.5% of the rated input at maximum firing.

5. Steam quality shall be 99% at the design operating pressure, regardless of firing rate up to rated capacity. Appropriate steam nozzle size selection size required for design operating conditions.

G. STEAM SKID PACKAGE SYSTEM

1. Packaged boiler skid system shall consist of a factory engineered system with all equipment mounted on structural steel bases with interconnected piping and electrical

wiring providing single-point process and power connections. Skidded equipment shall include the specified boiler(s), feed system, blowdown system, and all required water treatment accessories.

a. Skid bases shall consist of 4" x 4" structural steel tube framing with ¼" steel plate decking. Fork pockets are provided for rigging and installation.

b. The skid system shall be a modular approach with multiple skid base modules to facilitate shipping, handling, and installation.

c. For multiple skid module systems, skid bases shall be match-marked with union connections for piping and junction boxes for electrical wiring conduit at each skid module interface. All interconnecting wiring to be cut-to-length, landed, labeled and coiled at junction boxes at each skid module interface.

d. For multiple boiler skid systems, common headers and interconnecting piping shall be complete and installed. Sub-systems, such as steam headers shall be knocked down as required for shipment and installation.

e. All skid bases, steel piping, and structural supports shall be painted high temperature black.

f. Main Skid Control Panel shall be NEMA 4x enclosure and include main power fused disconnect, power transformer for line voltage loads, disconnect for boiler(s), fusing for all loads, Hand-Off-Auto switch(es), indicator light(s), starter(s) and overloads for pump(s). Minimum SCCR rating of 10kA.

2. Boiler feed receiver

a. Receiver shall be vertical welded 304 Stainless Steel

b. Head and shell thickness shall be 12 gauge

c. Receiver shall have a net working capacity of not less than that shown on the schedule

d. Receiver shall have an inlet, vent, overflow, drain

e. Receiver shall be furnished with:

1) Gauge Glass Assembly with SS Valves, High Pressure Gauge Glass and Heavy Duty SS Glass Guards

2) Bi-Metal Thermometer

3) Stainless Steel Suction Piping including SS Isolation Valves and SS Suction Strainer

3. Pump(s)

a. Boiler Feed water pump(s) shall be selected for the duty required.

1) Low Pressure -- Pumps shall be Single Stage Centrifugal type constructed of Cast 316 Stainless Steel, with Stainless Steel Impeller.

2) High Pressure – Pumps shall be Regenerative Turbine type with all-wetted components constructed of stainless steel.

3) Pump capacities and electrical characteristics shall be as shown on the schedule.

b. Each pump shall be sized for a minimum of 2 times the boiler evaporation rate.

c. Each pump shall be close coupled to a 3450 RPM C-Face TEFC motor

d. Mechanical shaft seal shall be rated for 250 degrees F continuous operation

e. Pump shall have a 5-year warranty against corrosion of the SS components

4. Water make-up assembly

a. The water make-up assembly shall consist of a float switch mounted at the water make-up level in the tank. A control system will electronically activate a solenoid valve to add softened make-up water to the tank.

b. A non-siphon filler well (air gap assembly) shall be provided.

5. BLOWDOWN SEPARATOR

a. Furnish and install as shown on plans:

b. (1) Boiler Blow-Down Separator for use with an intermittent bottom blowdown valve.

c. The separator is to be a Welded Carbon Steel Vessel Designed and "UM" Stamped to ASME Code for 250 psig @ 450 Deg. F. Plate Thickness 5/16”

d. Connections are threaded type and include a tangential inlet with stainless steel striking plate at point of impingement, a centrally located steam vent for clean quite release of steam to atmosphere, and bottom drain fitted with a stainless steel spiral baffle.

6. SEPARATOR ACCESSORIES

a. Furnish and install W/3 Angle Legs for Floor Mounting.

b. Furnish and install as shown on plans for Automatic Control of Drain Water Temperature to 140 Deg. F. A Automatic Aftercooler, a Temperature Regulator Vlave sized for cooling water at 50 psig., Strainer, and 2" Dial Bimetal Thermometer.

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2.3 Controls

A. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.

1. High Cutoff: Automatic reset stops burner if operating conditions rise above maximum boiler design pressure.

2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be automatic-reset type.

3. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

B. Building Automation System Interface: Factory-install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.

1. Hardwired Points:

a. Monitoring: On/off status, low water level alarm.

b. Control: On/off operation, steam pressure adjustment.

2. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.

2.4 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

1. House in NEMA 250, Type 4X enclosure.

2. Wiring shall be numbered and color-coded to match wiring diagram.

3. Install wiring outside of an enclosure in a metal raceway.

4. Field power interface shall be to wire lugs.

5. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker.

6. Provide each motor with overcurrent protection.

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2.5 SOURCE QUALITY CONTROL

A. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

B. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

C. Allow Owner access to source quality-control testing of boilers. Notify Architect 14 days in advance of testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.

1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

A. Install boilers skid level on concrete base.

B. Vibration Isolation: Elastomeric isolator pads. Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Install gas-fired boilers according to NFPA 54.

D. Assemble and install boiler trim.

E. Install electrical devices furnished with boiler but not specified to be factory mounted.

F. Install control wiring to field-mounted electrical devices.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to boiler to allow service and maintenance.

C. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.

D. Connect steam and condensate piping to supply-, return-, and blowdown-boiler tappings with shutoff valve and union or flange at each connection.

E. Install piping from safety relief valves to nearest floor drain.

F. Install piping from safety valves to drip-pan elbow and to nearest floor drain.

G. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

H. Connect breeching full size to boiler outlet. Comply with requirements in Division 23 Section "Breechings, Chimneys, and Stacks" for venting materials.

I. Install flue-gas recirculation duct from vent to burner. Comply with requirements in Division 23 Section "Breechings, Chimneys, and Stacks" for recirculation duct materials.

J. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

K. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform installation and startup checks according to manufacturer's written instructions.

2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.

3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

a. Burner Test: Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency.

b. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and steam pressure.

c. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Remove and replace malfunctioning units and retest as specified above.

D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

E. Performance Tests:

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.

2. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment in order to comply.

3. Perform field performance tests to determine the capacity and efficiency of boilers.

a. For dual-fuel boilers, perform tests for each fuel.

b. Test for full capacity.

c. Test for boiler efficiency at low fire, 20, 40, 60, 80, 100 percent of full capacity. Determine efficiency at each test point.

4. Repeat tests until results comply with requirements indicated.

5. Provide analysis equipment required to determine performance.

6. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.

7. Notify Architect in advance of test dates.

8. Document test results in a report and submit to Architect.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train] Owner's maintenance personnel to adjust, operate, and maintain boilers. Video training sessions. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 23 64 23 – SCROLL HEAT PUMP WATER CHILLERS

PART 1 – GENERAL

1.1 SUMMARY

A. Packaged, air-cooled, scroll heat pump water chillers.

1.2 QUALITY ASSURANCE

A. Certification: ARI 590.

B. Performance Rating: ARI 550/590.

C. Compliance: ASHRAE 15, ASHRAE/IESNA 90.1, ASME Boiler and Pressure Vessel Code, and NFPA 70.

1.3 COMPONENTS

A. Compressors: Positive-displacement, direct drive, hermetically sealed.

1. Capacity Control: On-off compressor cycling of compressors.
2. Sound-Reduction Package: Acoustic enclosure around compressors.

B. Compressor Motors: Hermetically sealed, refrigerant cooled, high-torque, two-pole induction type with inherent thermal-overload protection on each phase.

C. Motor Controllers: Across-the-line controller.

D. Refrigerant and Oil: R-410a

E. Refrigerant circuit isolation valves.

F. Evaporator: Brazed-plate direct-expansion design.

G. Air-Cooled Condenser: Copper tubes with aluminum fins with corrosion-resistant coating, rated at 650 psig.

H. Electrical Power: Factory wired for single-point field power connection.

1. Enclosure: NEMA 250, Type 4, lockable hinged access door.

I. Controls: Microprocessor based.

1. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display or light-emitting diodes.
2. Building Management System Interface: Communication interface.

J. Insulation for Cold Surfaces: Closed cell, flexible elastomeric.

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K. Accessories:
   1. Low ambient control.
   2. Water flow switch.
   3. Suction and discharge pressure gages.

1.4 SOURCE QUALITY CONTROL

A. Water Chillers: Factory functionally tested.

B. Performance tested according to ARI 550/590.

C. Evaporator: Factory tested and inspected according to ASME Boiler and Pressure Vessel Code.

D. Sound Power Level: ARI 370 rating procedures.

1.5 WARRANTY

A. Provide a full parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The contractor shall furnish and install air-cooled heat pump chiller with scroll compressors as shown as scheduled on the contract documents. The chillers shall be installed in accordance with this specification and perform at the specified conditions as scheduled.
   1. Trane model ACX
   2. Or approved Equal

2.2 CHILLER OPERATION

A. Chiller shall be capable of starting and running at outdoor ambient temperatures from 32ºF (0ºC) to 115ºF (46ºC).

B. Chiller shall be capable of starting up with 95ºF (35ºC) entering fluid temperature to the evaporator. Maximum water temperature that can be circulated with the Chiller not operating is 125ºF (52ºC)

C. Chiller shall provide evaporator freeze protection and low limit control to avoid low evaporator refrigerant temperature trip-outs during critical periods of chiller operation. Whenever this control is in effect, the controller shall indicate that the chiller is in adaptive limit. If the condition exists for more than 30 seconds, a limit warning alarm relay shall energize.

D. Rapid Restart™ after power restoration. The Chiller shall be capable of starting in 45 seconds.

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2.3 COMPRESSORS

A. Construct chiller using fully hermetic scroll type compressors with R410A optimized and dedicated scroll profile.

B. Provide direct drive motor cooled by suction gas with only three major moving parts and a completely enclosed compression chamber which leads to increased efficiency.

C. Each compressor shall have Intermediate Discharge Valves (IDV) or variable volume ratio technology

D. Each compressor shall have overload protection internal to the compressor

E. Each compressor shall include: centrifugal oil pump, oil level sight glass and oil charging valve

F. Each compressor will have crankcase heaters installed and properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles.

2.4 EVAPORATOR

A. The evaporator shall be a high efficiency, brazed plate-to-plate type heat exchanger consisting of parallel plates. Braze plates shall be stainless steel with copper braze material.

B. The water side working pressure shall be rated at 150 psig (10.3 bar) and tested at 1.5 times maximum allowable water side working pressure.

C. The refrigerant side working pressure shall be rated at 460 psig (29.6 bars) and tested at 1.1 maximum allowable refrigerant side working pressure.

D. Insulate the evaporator with a minimum of 0.75 inch (K=0.28) UV rated insulation. If the insulation is field installed, the additional money to cover material and installation costs in the field should be included in the bid.

E. Evaporator heaters shall be factory installed and shall protect chiller down to -20ºF (-29ºC). Contractor shall wire separate power to energize heat tape and protect evaporator while chiller is disconnected from the main power.

F. Provide water drain connection, vent and fittings. Factory installed leaving water temperature control and low temperature cutout sensors.

G. Water connections shall be grooved pipe.

H. Proof of flow shall be provided by the equipment manufacturer, mechanically installed and electrically wired, at the factory of origin.

I. Pump package includes: two high head pumps, two VFD, drainage valves, shut-off valves at entering and leaving connections. The pump package is single point power integrated into the chiller unit power with a separate factory wired control panel. The control of the pump is integrated into the chiller controller. The controller displays both of the evaporator pump starts and run-times. Freeze protection down to an ambient of -20ºF (-29ºC) is included as standard.

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The cold parts of the pump package will also be insulated. Designed with redundant pump and VFD, the chiller controls both pumps through a lead/lag and failure/recovery functionality. A variable speed drives are installed in an additional panel to control the pump. The VFD is adjusted upon start up to balance the system flow and head requirements. The purpose is to save on wasted pump energy caused by a traditional balancing valve. The drive has inputs to accept a signal from a BAS for variable primary flow.

2.5 FANS

A. Low sound fans shall be balanced and direct driven.

B. All condenser fan TEAO motors have permanently lubricated ball bearings and external overload protection.

C. All condenser fans shall have integrated drives to provide variable speed for optimized efficiency and lower part load sound.

2.6 CONDENSER

A. Construct condenser coils of aluminum fins mechanically bonded to internally finned copper tube. The condenser coils shall have an integral subcooling circuit and shall be designed for 650 psig or higher working pressure. Leak tested at 650 psig.

B. Condenser coils shall be transverse design. If coils are not transverse design, provide coil protection for shipping.

2.7 ENCLOSURES/CHILLER CONSTRUCTION

A. Unit panels, structural elements and control boxes are constructed of galvanized steel and mounted on a bolted galvanized steel base. Unit panels, control boxes and the structural base are finished with a baked on powder paint.

B. Control panel doors shall have door stays.

C. Mount starters and Terminal Blocks in a UL 1995 rated weatherproof panel provided with full opening access doors. If a circuit breaker is chosen, it should be a lockable, through-the-door type with an operating handle and clearly visible from outside of chiller indicating if power is on or off.

D. The coating or paint system shall withstand 500 hours in a salt-spray fog test in accordance with ASTM B117.

2.8 CHILLER MOUNTED STARTER

A. The starter shall be across-the-line configuration, factory-mounted and fully pre-wired to the compressor motor(s) and control panel.

B. Unit shall have a single point power connection.

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C. A molded case standard interrupting capacity circuit breaker shall be factory pre-wired with terminal block power connections and equipped with a lockable external operator handle, making it available to disconnect the chiller from main power.

D. A control power transformer shall be factory-installed and factory-wired to provide unit control power.

E. Unit wiring shall run in liquid-tight conduit.

F. High short circuit current rating (SCCR) of 10kA.

G. Customer wired 15 amp, 115-volt GFCI convenience outlet shall be factory mounted on the exterior of the control panel.

2.9 REFRIGERANT CIRCUIT

A. All chillers shall have 2 refrigeration circuits, each with two or three (manifolded) compressor on each circuit.

B. Provide for refrigerant circuit:
1. Liquid line shutoff valve
2. Discharge service valve
3. Filter
4. Liquid line sight glass.
5. Electronic expansion valve sized for maximum operating pressure
6. Charging valve
7. Reversing valve

C. Full operating charge of R410A and oil.

2.10 CONTROLS

A. A color, touch sensitive liquid crystal display (LCD) shall be unit mounted and a minimum of 7" diagonal.

B. Display shall consist of a menu driven interface with easy touch screen navigation to organized sub-system reports for compressor and evaporator information as well as associated diagnostics.

C. The chiller control panel shall provide password protection of all setpoints

D. The controller shall have the ability to display all primary sub-system operational parameters on dedicated trending graphs. The operator must be able to create up to 6 additional custom trend graphs, choosing up to 10 unique parameters for each graph to trend log data parameters simultaneously over an adjustable period and frequency polling.

E. Chilled water temperature control shall be microprocessor-based, proportional and integral controller to show water and refrigerant temperature, refrigerant pressure, and diagnostics. This microprocessor-based controller is to be supplied with each chiller by the chiller manufacturer.

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F. The front of the chiller control panel shall display the following in clear language, without the use of codes, look-up tables, or gauges:
1. Run time.
2. Number of starts.
3. Current chiller operating mode.
4. Chilled water set point and set point source.
5. Demand current limit set point and set point source.
6. Entering and leaving evaporator water temperatures.
7. Saturated evaporator and condenser refrigerant temperatures.
8. Evaporator and condenser refrigerant pressure.
9. Phase reversal/unbalance/single phasing and over/under voltage protection.
10. Low chilled water temperature protection.
11. High and low refrigerant pressure protection.
12. Load limit thermostat to limit compressor loading on high return water temperature.
13. Condenser fan sequencing to automatically cycle fans in response to load, expansion valve pressure, condenser pressure, and differential pressure to optimize chiller efficiency.
14. Display diagnostics.
15. Compressors: Status (on/off), anti-short cycle timer, and automatic compressor lead-lag.

G. Weatherproof control panel shall be mounted on chiller, containing starters, power and control wiring, factory wired with terminal block power connection. Provide primary and secondary fused control power transformer.

H. The chiller controller shall utilize a microprocessor that will automatically take action to prevent chiller shutdown due to abnormal operating conditions associated with: evaporator refrigerant temperature, high condensing pressure and motor current overload.

I. Provide the following safety controls with indicating lights or diagnostic readouts:
1. Low chilled water temperature protection.
2. High refrigerant pressure.
3. Loss of chilled water flow.
4. Contact for remote emergency shutdown.
5. Motor current overload.
6. Phase reversal/unbalance/single phasing.
7. Over/under voltage.
8. Failure of water temperature sensor used by controller.
9. Compressor status (on or off).

J. Provide the following operating controls:
1. A variable compressor staffing method to control capacity in order to maintain leaving chilled water temperature based on PI algorithms. Five minute solid state anti-recycle timer to prevent compressor from short cycling. Compressor minimum stop-to-start time limit shall be 2 minutes. If a greater than 5 minute start-to-start, or greater than 2 minute stop-to-start timer is included.
2. Chilled water pump output relay that closes when the chiller is given a signal to start.
3. Load limit thermostat to limit compressor loading on high return water temperature to prevent nuisance trips.
4. High ambient unloader pressure controller that unloads compressors to keep head pressure under control and help prevent high pressure nuisance trip outs on days when outside ambient is above design.

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5. Low ambient lockout control with adjustable setpoint.
6. Condenser fan sequencing which adjusts the speed of all fans automatically in response to ambient, condensing pressure and expansion valve pressure differential thereby optimizing chiller efficiency.

K. Provide user interface on the front of the panel. If display is on the inside of the panel, then a control display access door shall be provided to allow access to the display without removal of panels. Provide user interface with a minimum of the following features:
1. Leaving chilled water setpoint adjustment from the front panel touchscreen display.
2. Entering and leaving chilled water temperature output
3. Pressure output of condenser
4. Pressure output of evaporator
5. Ambient temperature output
6. Demand limit setpoint adjustment from the front panel touchscreen display.

L. The chiller control panel shall provide leaving chilled water temperature reset based upon return water temperature.

M. Digital Communications to BAS system shall consist of a BACnet MS/TP interface via a single twisted pair wiring.

2.11 SOUND

A. Acoustics: Manufacturer must provide both sound power and sound pressure data in decibels, per AHRI 370. A-weighted sound pressure at 30 feet should be provided at 100%, 75%, 50% and 25% load points to identify the full operational noise envelope.

B. If manufacturer cannot meet the noise levels, sound attenuation devices and/or barrier walls must be installed to meet this performance level.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's requirements.
1. Level the chiller using the base rail as a reference. The chiller must be level within 1/2 in over the entire length and width. Use shims as necessary to level the chiller.

3.2 SERVICE AND START-UP

A. Startup - Provide all labor and materials to perform startup. Startup shall be performed by a factory-trained technician from the original equipment manufacturer (OEM). Technician shall confirm that equipment has been correctly installed and passes specification checklist prior to equipment becoming operational and covered under OEM warranty. This shall be done in strict accordance with manufacturer's specifications and requirements. Third-party service agencies are not permitted.

B. A start-up log shall be furnished by the factory approved start-up technician to document the chiller's start-up date and shall be signed by the owner or his authorized representative prior to commissioning the chillers.

END OF SECTION 236423

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SECTION 23 73 23 - CUSTOM CENTRAL STATION AIR HANDLING UNITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Design, performance criteria, controls, and installation requirements for Custom Indoor Central Station Air Handling Units.

1.02 REFERENCES

A. AMCA Standard 99: Standards Handbook
B. AMCA /ANSI Standard 204: Balance Quality and Vibration Levels for Fans
C. AMCA Standard 210: Laboratory Methods of Testing Fans for Ratings
D. AMCA Standard 300: Reverberant Room Method for Sound Testing of Fans
E. AMCA Standard 500:Test Methods for Louvers, Dampers and Shutters
F. ARI Standard 410: Forced-Circulation Air-Cooling and Air-Heating Coil
G. ASHRAE Standard 52: Gravimetric and Dust Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter
H. ASHRAE/ANSI Standard 111: Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems
I. UL Standard 1995: Heating and Cooling Equipment
J. ASTM A-525: Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with Division 1.

B. Submittals shall include the following:
    1. Dimensioned plan and elevation view drawings, including motor starter and control cabinets, required clearances, and location of all field connections.
    2. Summary of all auxiliary utility requirements such as: electricity, water, compressed air, etc. Summary shall indicate quality and quantity of each required utility.
    3. Ladder type schematic drawing of the power and ancillary utility field hookup requirements, indicating all items that are furnished.
    4. Manufacturer’s performance of each unit. Selection shall indicate, as a minimum, the following:
        a. Input data used for selection.
        b. Model number of the unit.
        c. Net capacity.
        d. Rated load amp draw.
        e. Noise levels produced by equipment.
        f. Fan curves.
        g. Approximate unit shipping weight.

1.04 OPERATION AND MAINTENANCE DATA

A. Include data on design, inspection and procedures related to preventative maintenance. Operation and Maintenance manuals shall be submitted at the time of unit shipment.

1.05 QUALIFICATIONS

A. Manufacturer shall be a company specializing in the design and manufacture of commercial / industrial custom HVAC equipment. Manufacturer shall have been in production of custom HVAC equipment for a minimum of 5 years.

B. Each unit shall bear an ETL or UL label under UL Standard 1995 indicating the complete unit is listed as an assembly. ETL or UL listing of individual components, or control panels only, is not acceptable.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under the supervision of the owner.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate work performed under this section with work performed under the separate installation contract.

1.08 WARRANTY

A. The complete unit shall be covered by a parts warranty issued by the manufacturer covering the first year of operation. This warranty period shall start upon receipt of start-up forms for the unit or eighteen months after the date of shipment, whichever occurs first.

B. The installing contractor shall provide labor warranty during the unit's first year of operation.

PART TWO: PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Alliance
   2. Concepts and Designs, Inc.
   3. Energy Labs
   4. Haakon Industries, Ltd

2.02 GENERAL

A. Furnish and install where shown on the plans, mechanical frame style air handling units specifically designed for OUTDOOR application with construction features as specified below. The units shall be provided and installed in strict accordance with the specifications. All units shall be complete with all components and accessories as specified. Any exceptions must be clearly defined. The contractor shall be responsible for any additional expenses that may occur due to any exception made.

2.03 Factory Testing and Quality Control

A. Standard Factory Tests: The fans shall be factory run tested to ensure structural integrity and proper RPM. All electrical circuits shall be tested to ensure correct operation before shipment of unit. Units shall pass quality control and be thoroughly cleaned prior to shipment.

2.04 UNIT CONSTRUCTION DESCRIPTION

A. General: Provide factory-fabricated air handling units with capacity as indicated on the schedule. Units shall have overall dimensions as indicated and fit into the space available with adequate clearance for service as determined by the Engineer. Units shall be completely assembled. Multiple sectioned units shall be shipped as a single factory assembled piece (except where shipping limitations prevent) de-mounted into modular sections in the field by the contractor. Units shall be furnished with sufficient gasket and bolts for reassembly in the field by the contractor. Unit manufacturer shall provide certified ratings conforming to the latest edition of AMCA 210, 310, 500 and ARI 410. All electrical components and assemblies shall comply with NEMA standards. Unit internal insulation must have a flame spread rating not over 25 and smoke developed rating no higher than 50 complying with NFPA 90A, “Standard for the Installation of Air Conditioning and Ventilating Systems.” Units shall comply with NFPA 70, “National Electrical Code,” as applicable for installation and electrical connections of ancillary electrical components of air handling units. Tags and decals to aid in service or indicate caution areas shall be provided. Electrical wiring diagrams shall be attached to the control panel access doors. Operation and maintenance manuals shall be furnished with each unit. Units shall be UL or ETL listed.

B. Rigging Provision – Multiple Piece Units: Units shipped in multiple sections shall be engineered for field assembly. The base frame shall have integral lifting lugs. The lifting lugs shall be fabricated from Stainless-steel with an appropriate rigging hole. Lifting lugs shall be located at the corner of each section (and along the sides if required) and sized to allow rigging and handling of the unit. All gasket and necessary assembly hardware shall ship loose with unit. Junction boxes with a factory supplied numbered terminal strip shall be supplied at each shipping split for reconnection of control wiring.

Unit Base - Floor: Unit perimeter base shall be completely welded and fabricated using heavy gauge aluminum tubing. (Note: bolted bases are not acceptable) C-Channel cross supports shall be welded to perimeter base aluminum tubing and located on maximum 24” centers to provide support for internal components. Base rails shall include lifting lugs welded to perimeter base at the corner of the unit or each section if de-mounted. Entire base frame is to be painted with a phenolic coating for long term corrosion resistance. Internal walk-on floor shall be .125 stainless-steel (washable) tread plate.

C. The outer sub-floor of the unit shall be made from .063 Stainless-steel (washable). The floor cavity shall be spray foam insulated with floor seams gasketed for thermal break and sealed for airtight / watertight construction. Where access is provided to the unit interior, floor openings shall be covered with walk on phenolic coated steel safety grating. Single wall floors with glued and pined insulation and no sub floor are not acceptable. Base frame shall be attached to the unit at the factory.

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D. Unit Casing – The construction of the air handling unit shall consist of a (1" x 2") stainless-steel (washable) frame with formed .063 Stainless-steel (washable) exterior casing panels. The exterior casing panels shall be attached to the gasketed (1 x 2) stainless-steel (washable) frame with corrosion resistant fasteners. All casing panels shall be completely removable from the unit exterior without affecting the unit's structural integrity. The air handling unit casing shall be of the "no-through-metal" design. The casing shall incorporate insulating thermal breaks as required so that, when fully assembled, there's no path of continuous unbroken metal to metal conduction from inner to outer surfaces. Provide necessary support to limit casing deflection to L/200 of the narrowest panel dimension. If panels cannot meet this deflection, additional internal reinforcing is required. All panel seams shall be caulked and sealed for an airtight unit. Leakage rates shall be less than 1% at design static pressure or 9" W.C. whichever is greater.

The exterior panel finish shall be Painted with a polyester resin coating designed for long Term corrosion resistance meeting or exceeding (ASTM B-117) Salt Spray Resistance at 95 degrees F. 2500 hrs. and (ASTM D-2247) Humidity Resistance at 95 degrees F. 2500 hrs. The color shall be Manufacturer standard color.

E. Double Wall Liner - Each unit shall have double wall construction with .025 Stainless-steel (washable) liner in the entire unit. The double wall interior panel shall be removable from the outside if the unit without affecting the structural integrity of the unit.

F. Insulation - Entire unit to be insulated with a full 3" (R12.5) thick non-compressed fiberglass insulation. The insulation shall have an effective thermal conductivity (C) of .24 (BTU in./sq.ft. F°) and a noise reduction coefficient (NRC) of 0.70 / per inch thick (based on a type "A" mounting). The coefficients shall meet or exceed a 3.0 P.C.F. density material rating. Insulation shall meet the erosion requirements of UL 181 facing the air stream and fire hazard classification of 25/50 (per ASTM-84 and UL 723 and CAN/ULC S102-M88) and meet NFPA 90A and 90B. All insulation edges shall be encapsulated within the panel. All perforated sections shall have Micromat® or equal insulation with non-woven mat facing, 5000 fpm rating and non-hygroscopic fibers as manufactured by Johns Manville or approved equal.

G. Access Doors - The unit shall be equipped with a solid double wall insulated (same as the unit casing), hinged access doors as shown on the plans. The doorframe shall be stainless-steel (washable), foam filled with a built in thermal break barrier and full perimeter gasket. The door hinge assembly shall be completely adjustable die cast stainless steel. There shall be a minimum of two heavy duty handles per door. Provide ETL, UL 1995, and CAL-OSHA approved tool operated safety latch on all fan section access doors. Access doors (in the fan section) (all sections) shall be provided with a 10 x 10 dual thermal pane safety glass window.

H. Provide cross broke roofcap system to divert water from the top surface of the air handler. The rain shed roofcap shall have 2"standing seams covered with splice cap channels to seal top seam. Splice cap shall break down over sides of standing seam to protect the ends of the seam.
   1. Rooftop air handler cooling coil piping shall extend through the unit casing for field connection. The installing contractor shall insure that connecting piping is protected from weather.

2.05 UNIT COMPONENT DESCRIPTION

A. Unit Fans: All fans shall meet the air flow performance specified and shall not exceed the break horsepower or sound power levels specified on the mechanical equipment schedule. Fan performance shall be based on testing and be in accordance with AMCA Standards 210 and 300. All fans shall have a steep pressure/volume curve. Fan shaft shall be turned, ground and polished solid steel rated at maximum RPM below critical speed. Fan wheel and sheaves shall be keyed to the shaft. Fan shall be balanced per ANSI / AMCA 204-96 fan application category BV-3 using a digital signal analyzer at the design RPM with belts and drives in place to a vibration velocity less than or equal to 0.157 inches per second measured horizontal and vertical at each bearing pad. Vibration amplitudes are in inches/second-Peak. All values are filter-in at the fan speed. Fan assemblies shall be designed for heavy-duty industrial applications. Fan framing assemblies shall be fabricated from stainless-steel (washable). Formed load bearing members are not acceptable. The stainless-steel (washable) shall be welded together to form a rigid integral base. Fan assemblies shall be independently isolated with spring-type vibration isolators. Inlet cones shall be precision spun or die formed. Inlet cones shall be aerodynamically matched to the wheel side plate to provide streamlined airflow in the wheel and ensure full loading of the blades.

B. Coils – Water Coil

1. All coil assemblies shall be leak tested under water at 315 PSIG and PERFORMANCE is to be CERTIFIED under ARI Standard 410. Coils exceeding the range of ARI standard rating conditions shall be noted.

2. Coils shall be mounted on stainless steel support rack to permit coils to slide out individually from the unit. Provide intermediate drain pans on all stacked cooling coils. The intermediate pan shall drain to the main drain pan through a copper downspout. Water coils shall be constructed of seamless copper tubing mechanically expanded into fin collars. All fins shall be continuous within the coil casing to eliminate carryover inherent with a split fin design. Fins are die formed Plate type.

3. Headers are to be seamless copper with die formed tube holes.

4. Connections shall be male pipe thread (MPT) Schedule 40 Red Brass with 1/8" vent and drain provided on coil header for coil drainage. All coil connections shall be extended to the exterior of the unit casing by the manufacturer. Coils shall be suitable for 250 PSIG working pressure. Intermediate tube supports shall be supplied on coils over 44" fin length with an additional support every 42" multiple thereafter.

5. Water coils shall have the following construction:

Standard 5/8”:

- 5/8" o.d. x .025" wall copper tube with .028 return bends.
- .008" aluminum fins
- 16 gauge 304 stainless steel casing.

C. Condensate / Drain Pans - IAQ style drain pans shall be provided under all cooling coils as shown on the drawings. The drain pan shall be fabricated from 16 gauge 304 stainless steel. All pans are to be triple pitched for complete drainage with no standing water in the unit. They shall be insulated minimum 3-inch "Double Bottom" construction with welded corners. Provide stainless steel, 1-1/4” MPT drain connection extended to the exterior of the unit base rail. Units in excess

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of 159 inches shall have drain connections on both sides. All drain connections shall be piped and trapped separately for proper drainage.

D. Filters - Provide filters of the type indicated on the schedule. Factory fabricated filter sections shall be of the same construction and finish as the unit. Face loaded pre and final filters shall have Type 8 frames as manufactured by BLC, FARR or equal. Filter racks over 72" in length shall require an angle center reinforcement support. Side service filter racks shall be fabricated from no less than .063 Stainless-steel (washable) and include hinged access doors on both sides of the unit or as indicated on unit drawings. Internal blank-offs shall be provided by the air unit manufacturer as required to prevent air bypass around the filters.

1. Filter Gauge: Each Filter bank shall be furnished with Dwyer Series 2000 filter gauge or equal.

2. Medium Efficiency MERV 8 Pleated filters – Provide (2” or 4”) filters as specified on filter schedule. The filters shall be as manufactured by AAF, FARR or equal. Filters shall be in compliance with ANSI/UL 900 – Test Performance of Air Filters. Option: Provide (2) total sets of media.

E. Dampers – Provide Class 1 rated, ultra low leak dampers (less than 3 cfm/sq ft. @ 1” w.g.) as indicated on the unit drawings. Low leakage dampers shall have stainless-steel (washable) airfoil blades. Flat or formed metal blades are not acceptable. The damper blade shall incorporate santoprene rubber edge seals and zinc plated or stainless steel tubular steel shaft for a non-slip operation. Shaft bearings shall be spherical – non corrosive nylon to eliminate friction and any metal to metal contact. Damper jamb seals shall be UV rated, nylon glass reinforced or stainless steel spring arcs designed for a minimum air leakage and smooth operation. Damper linkage shall be concealed within a .063 Stainless-steel (washable) frame. Operator furnished and installed by control section.

F. Louvers:

1. Exhaust Air applications - Provide stainless-steel (washable) stationary louvers, drainable type with built in downspouts and birdscreen. Blades shall be housed inside a .063 Stainless-steel (washable) frame mounted to the unit exterior. Louver finish to match exterior unit finish.

2. Outside Air applications - Stainless-steel (washable) louvers shall be used at O/A location. Louvers shall be stationary, drainable type with built in downspouts and furnished with birdscreen. Blades shall be vertical and housed inside an stainless-steel (washable) frame mounted to the unit exterior. Louver finish to match exterior unit finish.

2.06 ELECTRICAL POWER AND CONTROLS

A. All electrical and automatic control devices not previously called out or listed below are to be furnished and installed in the field by the controls contractor.

B. All wiring shall be (75°C) Insulated copper wires.

C. The unit shall feature a mounted permanent nameplate displaying at a minimum the manufacturer, serial number, model number and current and amps voltage. The unit must have an ETL or UL Listing and bear the appropriate mark.

D. The unit shall feature a main non-fused disconnect of the proper amp rating to allow shutoff of all electrical motors and control items.

E. Motor Starters and Accessories – Provide a motor starter panel with main disconnect for each unit. Furnish electromechanical starters for all auxiliary electric motors required. Starter shall include overload protection devices in each of 3 phases. Contactors for electromechanical starters shall be UL.

END OF SECTION

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SECTION 23 81 26 – SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ductless single zone split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting and may be connected to ducts.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

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1.5 COORDINATION

A. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 07 Section "Roof Accessories."

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Carrier.
2. Mitsubishi.
3. Daikin AC.

2.2 WALL-MOUNTING, EVAPORATOR-FAN COMPONENTS

A. Cabinet: Heavy duty ABS and high impact polystyrene plastic with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

1. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
2. Drain Pan and Drain Connection: Comply with ASHRAE 62.1-2004.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Direct drive, centrifugal fan.

D. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

E. Filters: Permanent, cleanable

2.3 CONCEALED EVAPORATOR-FAN COMPONENTS

A. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.

1. Insulation: Faced, glass-fiber duct liner.
2. Drain Pans: Galvanized steel, with connection for drain; insulated and complying with ASHRAE 62.1-2004.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

D. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

E. Filters: Minimum MERV-13.

F. Wiring Terminations: Connect motor to chassis wiring with plug connection.

2.4 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: Twin Rotary.
2. Digitally controlled inverter driven compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
3. Refrigerant: R-407C or R-410A.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

E. Fan: Aluminum-propeller type, directly connected to motor.

F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: Permits operation down to 45 deg F.

H. Mounting Base: Polyethylene.

I. Minimum Energy Efficiency: Comply with ASHRAE/IESNA 90.1-2004, "Energy Standard for Buildings except Low-Rise Residential Buildings."

2.5 ACCESSORIES

A. Control equipment and sequence of operation are specified in Division 25 "Direct Digital Control and Energy Management System."

B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection, including auto setting.

C. Automatic-reset timer to prevent rapid cycling of compressor.

D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

1. Minimum Insulation Thickness: 1 inch thick where indoors, 1-1/2 inch thick with aluminum jacketing where outdoors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounting compressor-condenser components on equipment supports as detailed on the drawings. Anchor units to supports with removable, cadmium-plated fasteners.

D. Install seismic restraints.

E. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect outside air, supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

END OF SECTION

SECTION 23 82 19 - FAN COIL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes fan-coil units and accessories.

1.3 DEFINITIONS

A. BAS: Building automation system.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

2. and filters.

C. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.6 COORDINATION

A. Coordinate layout and installation of fan-coil units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate size and location of wall sleeves for outdoor-air intake.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Fan failure.
b. Coil leak.

2. Warranty Period: Five years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan-Coil-Unit Filters: Furnish two (2) spare filters for each filter installed.
2. Fan Belts: Furnish two (2) spare fan belts for each unit installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. In the Fan-Coil-Unit Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
1. Basis-of-Design Product: The design for each fan-coil unit is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 FAN-COIL UNITS

A. Basis-of-Design Product: Carrier Corp or a comparable product by one of the following:

B. Manufacturers:

1. Carrier Corporation.
2. Daikin/ McQuay
3. Trane.

C. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.

D. Coil Section Insulation: 1-inch thick, foil-covered, closed-cell foam complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.

1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

E. Main and Auxiliary Drain Pans: Stainless steel. Fabricate pans and drain connections to comply with ASHRAE 62.1-2004.

F. Chassis: Galvanized steel where exposed to moisture. Floor-mounting units shall have leveling screws.

G. Cabinet: Steel with baked-enamel finish in manufacturer's standard paint color as selected by Architect.

1. Vertical Unit Front Panels: Removable, cam fasteners, and insulation on back of panel.
2. Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners and hinge and attached with safety chain; with cast-aluminum discharge grilles.
3. Stack Unit Discharge and Return Grille: Aluminum double-deflection discharge grille, and louvered- or panel-type return grille; color as selected by Architect from manufacturer's custom colors. Return grille shall provide maintenance access to fan-coil unit.
4. Steel recessing flanges for recessing fan-coil units into ceiling or wall.

H. Outdoor-Air and Return-Air Dampers: Galvanized Metal With Gears Comprised of Polybutylene Terephthalate (PBT) Flame Retardant 30% Glass Filled, with ultra low leak fault detection and diagnostics controls. Honeywell Jade W7220 Controller, Adjustable Dry Bulb Sensor, Honeywell Actuator.

I. Filters: Minimum airestance according to ASHRAE 52.1, and a minimum efficiency reporting value of MERV-13.

J. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.

K. Fan and Motor Board: Removable.

1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.

2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
3. Wiring Termination: Connect motor to chassis wiring with plug connection.

L. Control devices and operational sequences are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls."

M. Basic Unit Controls:

1. Control voltage transformer.
2. Wall-mounting thermostat with the following features:

    a. Heat-cool-off switch.
    b. Fan on-auto switch.
    c. Fan-speed switch.
    d. Automatic changeover.
    e. Adjustable deadband.
    f. Exposed set point.
    g. Exposed indication.
    h. Degree F indication.
3. Unoccupied-period-override push button.
4. Data entry and access port.

    a. Input data includes room temperature, and humidity set points and occupied and unoccupied periods.
    b. Output data includes room temperature and humidity, supply-air temperature, entering-water temperature, operating mode, and status.

N. DDC Terminal Controller:

1. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
2. Unoccupied Period Override Operation: Two hours.
3. Unit Supply-Air Fan Operation:

    a. Occupied Periods: Fan runs continuously.
    b. Unoccupied Periods: Fan cycles to maintain room setback temperature.

4. Hydronic-Cooling-Coil Operation:

    a. Occupied Periods: Modulate control valve to maintain room temperature.
    b. Unoccupied Periods: Close control valve.

5. Heating-Coil Operation:

    a. Occupied Periods: Modulate control valve to provide heating if room temperature falls below thermostat set point.
    b. Unoccupied Periods: Start fan and modulate control valve if room temperature falls below setback temperature.

O. BAS Interface Requirements:

1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at the central workstation.
3. Provide BACnet interface for central BAS workstation for the following functions:

a. Adjust set points.
b. Fan-coil-unit start, stop, and operating status.
c. Data inquiry, including outdoor-air damper position, supply- and room-air temperature.
d. Occupied and unoccupied schedules.

P. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive fan-coil units for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping and electrical connections to verify actual locations before fan-coil-unit installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fan-coil units level and plumb.

B. Install fan-coil units to comply with NFPA 90A.

C. Suspend fan-coil units from structure with elastomeric hangers. Vibration isolators are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

D. Verify locations of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation.

E. Install new filters in each fan-coil unit within two weeks after Substantial Completion.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Install piping adjacent to machine to allow service and maintenance.

2. Connect piping to fan-coil-unit factory hydronic piping package.
3. Connect condensate drain to indirect waste.

    a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.

B. Connect supply and return ducts to fan-coil units with flexible duct connectors specified in Division 23 Section "Air Duct Accessories." Comply with safety requirements in UL 1995 for duct connections.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fan-coil units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Materials and equipment shall be furnished and installed in support of electrical work described in these plans and specifications including but not limited to, raceways, boxes, enclosures, feeders, branch circuiting, supports, terminal cabinets, sleeves, gutters, panels, transformers, switchgear, lighting fixtures, controls, relays, contactors, in order to complete and make fully functional the systems described.
   2. Complete fire alarm and annunciation system as shown and/or required by the (local jurisdiction having authority, California State Fire Marshal) including connection to monitoring equipment and wiring for central station connection through Campus Fire Alarm Network.
   3. Lighting systems, both interior and exterior as shown on the plans and as specified herein, including controls, occupancy sensors, lumen sensors, photocell controls, lamps, dimmers, supports, fasteners, straps, and miscellaneous mounting hardware and support structures for such equipment.
   4. Duct banks and raceways for all power and communications systems as shown and/or required. Duct banks shall include all trenching, racking, conduit, concrete, backfill, boxes, pads, substructures required for a fully developed and useable pathway for cables, conductors, as shown on site, etc.
   5. HVAC and plumbing electrical: Conduit, conductors and terminations for all line voltage power, line voltage controls and fusible and/or non-fusible safety disconnect switches for HVAC equipment, including but not limited to air conditioners, furnaces, fans, heat pumps, system pumps, condensing units. Provide protective equipment unless otherwise noted, etc. including protective devices.
   6. Plumbing Electrical: Conduit, conductors and terminations for plumbing equipment with power requirements including necessary fusible and/or non-fusible safety disconnect devices. Provide motor starters where required unless provided by mechanical specification.
   7. Power and Lighting Distribution: Furnish and install power and lighting distribution systems including but not limited to panels, feeders, transformers, branch circuits, devices, fixtures, disconnect switches, contactors, controls, etc. for a complete working system.
   8. Data systems infrastructure including all boxes, raceways, cable tray, wire basket tray, dedicated branch circuits, sleeves and penetrations, etc. as described and as shown in plans, risers, specifications, EIA/TIA standards and/or required for a complete and operating system.

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9. Master clock system including master Global Positioning System (GPS), antenna, retransmitter, controller, clocks, backboxes, conduits/conductors, connectors, terminations, cabinets, etc. as required for a complete and operating system.
10. Lighting acceptance testing, documentation and completion of required forms as specified in Section 26 56 70, LIGHTING ACCEPTANCE TESTING.
11. Allocation of time to adequately train the Owner on the use and operation of all systems installed within the facility or on the property. Minimum two week advance notice shall be coordinated with the Owner and his representatives. Training shall be as outlined in individual system specifications identified to follow.

B. Related Sections Under Other Divisions:
1. Mechanical Wiring: Control circuit wiring, energy management controls and interlocks for mechanical equipment shall be installed by Mechanical Contractor.
2. Painting of electrical equipment where exposed and required by the Architect to be painted as described elsewhere in the specification.
3. Irrigation System: Provide all line voltage (50 volts or above) connections to irrigation system equipment, time clocks and or powered satellite controls. Coordinate locations of this work with the Landscape Contractor.
4. Pole Bases: Contractor shall be responsible to furnish light standard concrete pole bases, rebar, bolt templates and anchor bolt kits for a complete installation. Concrete, rebar, excavation shall be by Contractor in accordance with all parts of this specification.
5. HVAC Control Raceway: Raceways, boxes, and control wiring for thermostats, temperature sensors and control components specified within the mechanical specifications, shall be furnished and installed as required by Division 25 and installed in accordance with the minimum wiring methods allowed for branch circuit wiring in Division 26 (the DDC systems/EMS systems and components are installed in accordance with Division 25).
6. Smoke Fire Dampers (when applicable): Coordination with Mechanical plans for exact locations and points of connection for power and fire alarm system connections (power and fire alarm connection shall be by Electrical Contractor).
7. Duct mounted smoke detectors (when applicable): Coordination with Mechanical plans for exact locations and points of connection for power and fire alarm system connections (power and fire alarm connection shall be by Electrical Contractor).
8. Security System: Shall be installed by Owner’s vendor. Contractor shall provide conduits, boxes, stubs to accessible ceilings, dedicated circuit(s) for alarm panel, access control system (key pads, electric locks), etc. as shown and/or required by the Owner’s vendor.

1.3 SYSTEM DESCRIPTION

A. The electrical plans indicate the general layout and arrangement; the architectural drawings and field conditions shall determine exact locations. Field verify all conditions and modify as required to satisfy design requirements as well as code minimums. Maintain all required working clearances as described in CEC Article 110 as well as other applicable articles.

B. Discrepancies shall be brought immediately to the attention of the Architect for clarification. The Architect shall approve any changes. Prior to rough-in, refer to architectural plans that shall take precedence over electrical plans with respect to locations.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Refer to Section 012500 SUBSTITUTION PROCEDURES and Section 013300 SUBMITTAL PROCEDURES.

B. Before construction, submit in (accordance with the General Conditions of this Specification) a complete list of all materials proposed to be furnished and installed under this section. Any material procured without review and approval of the engineer and/or owner's representative will solely be at the contractor's risk.

C. Manufacturers' specifications, catalog cuts and shop drawings as required to demonstrate compliance with the specifications. Identify specific intended use for each component where submittal may be ambiguous. Submit entire bound submittal at one time; partial submittals will not be accepted. At a minimum, submittals will be required for the following:
   1. Site work equipment including ducts, conduits, fittings, concrete and fiberglass pull, manhole, boxes, vaults, trench racks, accessories, etc.
   2. Distribution equipment including distribution switchgear, transformers, distribution panels and breakers, motor controls, distribution and branch circuit panels, grounding, transient voltage surge suppressors, etc.
   3. Electrical equipment including disconnects, fuses, raceways, straps and racks, fittings, conductors, boxes, gutters, floor duct, devices, plates, etc.
   4. Lighting equipment including fixtures, lamps, mounting accessories, color charts (where required), etc.
   5. Lighting control equipment including low voltage switching system, dimmer switchbank / accessories, occupancy sensing equipment, time clocks, contactors, photocells, lumen sensors, etc.
   6. Constructability review letter/comments for lighting acceptance testing as required by Section 26 56 70, LIGHTING ACCEPTANCE TESTING.
   7. Complete system component submittals and shop drawings for:
      a. Access Control Systems for door access control, including but not limited to; cables, power supplies, patch panels, I/O cards, batteries, etc.
      b. Communication Systems including but not limited to; cable, fiber, terminations, cable management, cable tray, patch panels, equipment racks, specified active electronics (where called for), cabinets, jacks, plates, cable labeling, testing procedure.
   8. Conduit including all fittings, etc.
   9. Wiring and cable, terminations, etc.
   10. Fire rating penetration materials, details, etc.

D. The intent of these specifications is to establish a standard of quality for materials and equipment. Therefore, some items are identified by manufacturer or trade name designation. Substitutions shall be subject to the Architect's approval. Samples of the proposed and substitute materials may be required for inspection prior to approval. Costs, if any, for evaluation of substitutions shall be the Contractor's responsibility. The decision of the Architect shall be final. Where the substitution will affect other trades, coordinate all changes with those trades concerned and pay any additional costs incurred by them as a result of this substitution. Approval of substitutions shall not relieve the Contractor from providing an operational system in accordance with all applicable codes and ordinances.

E. SUPPORTING DEVICES
   1. Provide all details of suspension and support for ceiling hung equipment.

2. Where walls, floor, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the submittals must include spacing, static loads and seismic loads at all attachment and support points.
3. Provide seismic details of seismic restraints and anchors; including number, size and locations for each piece of equipment.

1.5 DELIVERY, STORAGE AND HANDLING

A. Storage of equipment for the job is the responsibility of the Electrical Contractor and shall be scheduled for delivery to the site, as the equipment is required. Damage to the equipment delivered to the site or in transport to the job shall be the responsibility of the Electrical Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall be new and bear the label of or be listed by a nationally recognized testing laboratory. The quality and suitability of all materials shall conform to the standards and practices of this trade.

B. Supplied materials shall be of a current manufactured product line. Discontinued products are not acceptable. Where products are identified on the contract documents by part number, supply the current product model or series which meets the specification and intended use of the specified component.

2.2 SUPPORTING DEVICES

A. Hangers: Kindorf B-905-2A Channel, H-119-D washer, C105 strap, 3/8” rod with ceiling flange.

B. Concrete Inserts: Kindorf D-255, cast in concrete for support fasteners for loads up to 800 lbs.

C. Pipe Straps: Two-hole galvanized or malleable iron.

D. Luminaire Chain: Campbell Chain 75031, 90-lb. test with steel hooks.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Professionalism and appearance of installations shall be in accordance with accepted practices of this trade. Installation methods shall conform to manufacturers' specifications and recommendations. The Contractor shall man the job with qualified journeymen and helpers in

this trade for the duration of the job. It is the Contractor's responsibility to communicate with and keep the job superintendent appraised of changes or clarifications, etc.

B. Employment of any person on any job in the capacity of an electrician is not permitted unless such person has qualified for and holds a valid Journeyman Electrician Pocket Card or General Journeyman Electrician Certificate issued by the State of California Division of Apprenticeship Standards except, Contractor may employ electrical helpers or apprentices on any job of electrical construction, new or existing, when the work of such helpers or apprentices is performed under the direct and constant personal supervision of a journeyman electrician holding a valid Pocket Card accepted by the State of California Division of Apprenticeship Standards.
   1. Each Pocket Card carrying journeyman electrician will be permitted to be responsible for the quality of workmanship for a maximum of one helper or apprentice during any same time period, provided the nature of work is such that good supervision can be maintained and the quality of workmanship is the best, as expected by Owner and implied by the latest edition of the National Electrical Code.
   2. Before each journeyman electrician commences work, deliver to Owner at the project site, a photocopy of the journeyman’s valid Pocket Card.

C. Materials shall be installed in accordance with the manufacturers' specification and recommendations. They must conform to the approval AHJ adopted codes and standards, but not less than the 2022 CEC and all applicable codes and standards, including but not necessarily limited to California Code of Regulations Title 24, NFPA, National Electrical Manufacturers Association, ANSI, CBC, and any other adopted ordinances of applicable agencies having jurisdiction. Refer to general conditions of specifications.

D. Electrical Contractor shall lay work out in advance to avoid unnecessary cutting, chasing, and drilling of floors, walls, ceilings and other surfaces. Work of this nature shall be carefully done so as not to damage work already performed by other trades. Any damage which results must be properly repaired at no extra cost to the Owner. Such alterations shall not depreciate the integrity of the structure. Approval for cuts or penetrations in structural members shall be by the Architect.

E. Supporting Devices:
   1. Verify mounting height of all luminaires or items prior to installation when heights are not detailed.
   2. Install vertical support members for equipment and luminaires, straight and parallel to building walls. Provide independent supports to structural member for electrical luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over furred or suspended ceilings.
   3. Do not use other trade’s fastening devices as supporting means for electrical equipment, materials or luminaires. Do not use supports or fastening devices to support other than one particular item.
   4. Support conduits within 18” of outlets, boxes, panels, cabinets and deflections. Maximum distance between supports not to exceed 8’ spacing.
   5. Securely suspend all junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from the floor above or roof structure to prevent sagging and swaying.
   6. Provide seismic bracing per UBC requirements for this building location.
   7. Supporting Devices: Safety factor of 4 required for every fastening device or support for electrical equipment installed. Support to withstand four times weight of equipment it

supports. Bracing to comply with seismic design category “SDC” per Structural Engineer.

F. Coordinate work with other trades as required to eliminate any delays during construction. Coordinate changes with other prime contractors to avoid construction conflicts.

G. Engineer's Field Observation: Site visits during construction for field observations and reports will be conducted by electrical engineer when directed by the Architect. A list of items that need to be addressed will be submitted to the Architect for forwarding to the Contractor. A written response to all items shall be submitted for Owner’s review once complete. When Electrical Engineering representative performs a field observation, the Electrical Contractor shall be present and available to remove equipment covers as needed.

H. Drawings of Record: Provide a full and accurate set of field record drawings marked up in a neat and understandable manner submitted to the Owner Representative, Construction Manager, or Architect upon completion of the work and prior to issuance of a certificate of completion. The drawings shall dimension all electrical facilities including but not limited to underground conduit, vaults, boxes as well as conduit routing scaled to within 12" of actual field conditions and shall be kept up to date daily reflecting changes or deviations. Electrical facilities shall be accurately drawn on the plan to scale. Refer to the general conditions of these specifications for additional requirements. Record drawings shall be required to identify both horizontal and vertical dimensions to visible and fixed points such as concrete, asphalt, buildings, sidewalks, etc.

I. Identification: Provide engraved laminated plastic nameplates for all switchboards, panelboards, fire alarm terminal cabinets, telephone and cable television backboards, main devices, control panels, time clocks, contactors and safety disconnect switches accurately identifying each device. Labels shall be attached to the equipment by means of screws or rivets. Self-adhering labels will not be acceptable. Refer to Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.

J. Safety: The Electrical Contractor is responsible to maintain equipment in a safe and responsible manner. Keep dead front equipment in place while equipment is energized. Conduct construction operations in a safe manner for employees as well as other work persons or anyone visiting the job site. Provide barriers, trench plates, flags, tape, etc. The Contractor shall hold all parties harmless of negligent safety practices that may cause injury to others on or near the job site.

K. Guarantees: Equipment and labor shall be guaranteed and warranted free of defects, unless otherwise stated to be more restrictive, for a period of one year from the date of final acceptance by the Owner. A written warranty shall be presented to the Architect at the time of completion prior to final acceptance. Equipment deemed to be damaged, broken or failed should be repaired or replaced at no additional cost to the Owner. Materials or system requiring longer than a one-year warranty as described herein shall be separately warranted in separate letters of guarantee stating the duration of warranty.

L. Operating and Installation Manuals: Provide two copies each of manuals, operating and installation instructions for equipment indicated in submittal packages. Instruct the Owner's representative as to the operation and location of equipment necessary to allow them to operate the facility upon final acceptance. This instruction period shall be prearranged with the Owner's representative prior to occupancy of the facility and the weeks prior to training scheduled.

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M. Lighting Acceptance Testing: Provide two copies of lighting acceptance testing results and equipment operating manuals as specified in Section 26 56 70, LIGHTING ACCEPTANCE TESTING. Instruct the Owner on operation of control systems.

END OF SECTION

SECTION 26 05 13 – MEDIUM VOLTAGE CABLES (Above 600 Volts)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Medium voltage cables (cable for systems above 600 volt).

B. Related Work:
   1. Bedding of conduits: Section 31 20 00, EARTHMOVING.
   2. General electrical requirement and items that are common to more than one section of Division 26: Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   3. Conduits for medium voltage cables: Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
   4. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

1.3 SUBMITTALS

A. Submit in accordance with the general conditions of the specification and Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Shop Drawings:
   1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
   2. Include splice and termination kit submittal information prior to purchase and installation.

C. Installer Approval:
   1. Employees who install the splices and terminations shall have not less than three years of experience splicing and terminating cables which are equal to those being spliced and terminated, including experience with the materials in the kits.
   2. Furnish satisfactory proof of such experience for each employee who splices or terminates the cables to the Inspector of Record (IOR).

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1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the designation only.

B. Underwriters Laboratories (UL):
   1. 1072-2001 Safety Medium-Voltage Power Cables

C. National Fire Protection Association (NFPA):
   1. 70-2002 California Electrical Code (CEC)

D. National Electrical Manufacturers Association (NEMA):
   1. WC71-99 Standard for Non-Shielded Cables Rated 2001-5000 Volts for Use in the Distribution of Electrical Energy.
   2. WC74-20005-46 KV Shielded Power Cable for Use in the Transmission and Distribution of Electrical Energy.

E. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   1. 48-96 Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 KV Through 765 KV

F. 386-95 (R2001) Separable Insulated Connector Systems for Power Distribution Systems above 600 V

G. 404-2000 Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500-500,000 Volts

H. 592-90 (R1996) Exposed Semi-conducting Shields on High-Voltage Cable Joints and Separable Insulated Connectors

PART 2 - PRODUCTS

2.1 MATERIAL, MEDIUM VOLTAGE CABLE

A. Medium voltage cable shall be EPR MV-105, in accordance with the CEC and NEMA WC71, WC74 and UL 1072. Approved manufacturers are General Electric, General Cable, Rome, Okonite, or Engineer approved equal.

B. Shall be single conductor stranded copper with ground shield and fully jacketed.

C. Insulation:
   1. Insulation level shall be 133 percent.
   2. Types of insulation:
      a. Cable type abbreviation, EPR: Ethylene propylene rubber insulation shall be thermosetting, light and heat stabilized.
      b. Cable type abbreviation, CCLP: Polyethylene insulation shall be thermosetting, light and heat stabilized, chemically crosslinked.

D. Conductors and insulation shall be wrapped separately with semiconducting tape.

E. Insulation shall be wrapped with non-magnetic, metallic shielding.

F. Heavy duty, overall protective jackets of chlorosulphonated polyethylene, neoprene or polyvinyl chloride shall enclose every cable.

G. Cable temperature ratings for continuous operation, emergency overload operation and short circuit operation shall be not less than the NEMA WC71 or WC74 Standard for the respective cable.

H. Manufacturer's name and other pertinent information shall be marked or molded clearly on the overall outside surface of the jackets, or incorporated on marker tapes within the cables at reasonable intervals.

2.2 MATERIAL, SPLICES AND TERMINATIONS

A. The materials shall be compatible with the conductors, insulations and protective jackets on the cables and wires. Approved manufacturers are 3M, Elastimold, Raytheon or approved equal.

B. The splices shall insulate and protect the conductors not less than the insulation and protective jackets on the cables and wires which protect the conductors. In locations where moisture might be present, the splices shall be watertight. In manholes and handholes the splices shall be submersible.

C. Splicing and Terminating Fittings: Shall be in accordance with IEEE 386, 404 and 592.
   1. Shall be heavy duty, pressure type fittings, which will assure satisfactory performance of the connections under conditions of temperature cycling and magnetic forces from available short circuit currents.
   2. The fittings shall be suitably designed and the proper size for the cables and wires being spliced and terminated. Terminations to bus shall be with two-hole lugs.

D. Splicing and Terminating Kits:
   1. General:
      a. Shall be assembled by the manufacturer or supplier of the materials and shall be packaged for individual splices and terminations or for groups of splices and terminations.
      b. Shall consist of materials designed for the cables being spliced and terminated and shall be suitable for the prevailing environmental conditions.
      c. Shall include detail drawings and printed instructions for each type of splice and termination being installed, as prepared by the manufacturers of the materials in the kits.
      d. Detail drawings, and printed instructions shall indicate the cable type, voltage rating, manufacturer's name and catalog numbers for the materials indicated.
      e. Voltage ratings for the splices and terminations shall be not less than the voltage ratings for the cables on which they are being installed.
      f. Shall include shielding and stress cone materials.
   2. Epoxy resin kits shall be as follows:
      a. Compatible with the cable insulations and jackets and make the splices watertight and submersible.
      b. Thermosetting and generate its own heat so that external fire or heat will not be required.

c. Set solid and cure in approximately 60 minutes in 21 degree C (70 degree F) ambient temperature.
d. Not deteriorate when subjected to oil, water, gases, salt water, sewage and fungus.
e. Furnished in pre-measured quantities, sized for each splice and each termination, with two resin components in an easy mixing plastic bag which will permit mixing the resin without entrapping air or contaminants. Other methods of packaging and mixing the epoxy resin components will be considered for approval, provided they include adequate safeguards to assure precise proportioning of the resin components and to prevent entrapping air and contaminants.
f. Use snap-together, longitudinally-split, interlocking seam, transplant mold bodies or taped frameworks, injection fittings and injection gun or pouring equipment. Completely fill voids within the splices and terminations.

E. Premolded Rubber Splices and Terminations:
1. Splices and terminations shall be in accordance with IEEE 48, 386, 404 and 592.
2. Premolded rubber devices shall have a minimum of .125” semiconductive shield material covering the entire housing. Test each rubber part prior to shipment from the factory.
3. Grounding of metallic shields shall be accomplished by a solderless connector enclosed in a watertight rubber housing covering the entire assembly. The grounding device and splice or terminator shall be of same manufacturer to insure electrical integrity of the shielded parts.
4. The premolded parts shall be suitable for indoor, outdoor, submersible, or direct burial applications.

PART 3 - EXECUTION

3.1 INSTALLATION, HIGH VOLTAGE CABLE

A. Installation shall be in accordance with the CEC, and as shown on the drawings.

B. Use suitable lubricating compounds on the cables and wires to prevent damage to them during pulling in. Provide compounds that are not injurious to the cable and wire jackets and do not harden or become adhesive.

C. Splicing of cables is allowed only with prior approval from the engineer. Splice the cables and wires only in manholes and accessible junction boxes where unavoidable. Ground shields in accordance with Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

D. In manholes, trenches and vaults install the cables on suitable porcelain insulators with steel cables racks. Ground cable racks in accordance with Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

E. In manholes, underground raceways and other outdoor locations:
1. Seal the cable ends prior to pulling them in to prevent the entry of moisture.
2. For ethylene propylene rubber and polyethylene insulated cables, use bags of epoxy resin which are not less than 1/4" larger in diameter than the overall diameter of the cable. Clean each end of each cable before installing the epoxy resin over it.

3.2 INSTALLATION, SPLICES AND TERMINATIONS

A. Install the materials as recommended by their manufacturer including special precautions pertaining to air temperature during installation.

B. Ethylene Propylene Rubber and Polyethylene Insulated Cables:
   1. Cables rated 8000 volts or less: Install epoxy resin splices and terminations, or premolded rubber splices and terminations.
   2. Cables rated more than 8000 volts: Install premolded rubber splices and terminations.

C. Installation shall be accomplished by qualified personnel trained to accomplish high voltage equipment installations. All instructions of the manufacturer shall be followed in detail.

3.3 FEEDER IDENTIFICATION

A. In each manhole and pullbox install permanent tags on each circuit's cables and wires to clearly designate their circuit identification and voltage. In manholes the tags shall be the embossed brass type and shall also show the cable type and voltage rating. Position the tags so they will be easy to read after the fireproofing is installed. See Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.

3.4 FIELD TESTS FOR MEDIUM VOLTAGE CABLE

A. New Cable:
   1. Acceptance tests shall be performed on new cable in accordance with IEEE 48 and as specified herein.
   2. Test new cable after installation, splices, and terminations have been made, but before connection to equipment and existing cable.

B. High Potential Test:
   1. Leakage current test shall be by high potential DC step voltage method.
   2. Prior to high potential test, test the cable and shields for continuity, shorts, and grounds.
   3. High potential test shall measure the leakage current from each conductor to the insulation shield. Use corona shields, guard rings, taping, mason jars, or plastic bags to prevent corona current from influencing the readings. Unprepared cable shield ends shall be trimmed back 1” or more for each 10 kV of test voltage.

C. Safety Precautions:
   1. Exercise suitable and adequate safety measures prior to, during, and after the high potential tests, including placing warning signs and preventing people and equipment from being exposed to the test voltages.

D. Test Voltages:
   1. New shielded EPR and CCLP cable DC test voltages shall be as follows:

		Test Voltage KV	
Rated Circuit Voltage Phase-to-Phase Volt	Wire Size AWG or MCM	100 percent Insulation Level	133 percent Insulation Level

2001-5000	8-1000	25	25
5001-8000	6-1000	35	35
8001-15000	2-1000	55	65
15001-25001	1-1000	80	100

E. High Potential Test Method:
   1. Apply voltage in approximately 8 to 10 equal steps.
   2. Raise the voltage slowly between steps.
   3. At the end of each step, allow the charging currents to decay, and time the interval of decay.
   4. Read the leakage current and plot a curve of leakage currents versus test voltage on graph paper as the test progresses. Read the leakage current at the same time interval for each voltage step.
   5. Stop the test if leakage currents increase excessively or a "knee" appears in the curve before maximum test voltage is reached.
      a. Repair or replace the cable and repeat the test.
   6. Upon reaching maximum test voltage, hold the voltage for five minutes. Read the leakage current at 30 second intervals and plot a curve of leakage current versus time on the same graph paper as the step voltage curve. Stop the test if leakage current starts to rise, or decreases and again starts to rise. Leakage current should decrease and stabilize for good cable.
   7. Terminate test and allow sufficient discharge time before testing the next conductor.

F. The contractor shall furnish the instruments, materials and labor for these tests and forward the results in a single bound copy to Engineer, indicating compliance with specification and manufacturers installation requirement.

END OF SECTION

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SECTION 26 05 19 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Wires and cables.
   2. Connectors.
   3. Lugs and pads.

1.3 SYSTEM DESCRIPTION

A. Provide wires, cables, connectors, lugs, strain reliefs, racking insulators for a complete and operational electrical system.

1.4 SUBMITTALS

A. Provide product data for the following equipment:
   1. Wires.
   2. Cables.
   3. Connectors.
   4. Lugs.
   5. Splice Kits.
   6. Strain Relief Fittings.
   7. Cable Racking and Insulators.

B. Provide the insulation cable testing report in the project closeout documentation, refer to Closeout Requirements in the General Conditions portion of this specification.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of the CEC, latest adopted version with amendments by local Authority Having Jurisdiction (AHJ).

B. Furnish products listed by UL or another testing firm acceptable to AHJ.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wires and Cables: General Cable, Okonite, Southwire, or approved equal.

B. Connectors: Burndy, Ilsco, Thomas & Betts, or approved equal.

C. Wire connectors shall be minimum 75 degree centigrade rated and properly sized for the number of conductors being connected, terminated, spliced etc. All above grade connectors shall be solderless lug or plastic wire nut type, screw on, pressure cable type (wire nut or spring nut type), 600 volt, 105 degree C, with skirt to cover all portions of stripped wires. Connector shall be U.L. rated for number and size of conductors being joined together as a splice.

D. Splices:
1. Branch Circuit Splices: Ideal, Scotch-Lock, 3M, or approved.
2. Feeder Splices: Compression barrel splice with two layers Scotch 23 and four layers of Scotch 33+ as vapor barrier.
3. Screw Terminal Lugs.
4. Kearney Split Bolt.

2.2 WIRES AND CABLES FOR LINE VOLTAGE SYSTEM AND CONTROLS. WIRE AND CABLE SHALL BE:

A. Copper, 600 volt rated throughout. Conductors 14AWG to 10AWG, solid or stranded. Conductors 8AWG and larger, stranded.

B. Phase color to be consistent at all feeder terminations; A-B-C, top to bottom, left to right, front to back. Phasing tape shall be permitted on sizes #6 and larger.

C. Color Code Conductors as Follows:

PHASE	208 VOLT	480 VOLT
A	Black	Brown
B.	Red	Orange
C.	Blue	Yellow
Neutral	White	White w/ colored strip
Ground	Green	Green

D. All conductors shall be copper unless otherwise noted. Minimum size for individual conductors shall be #12 AWG unless otherwise noted. Sizes #8 AWG and larger shall be stranded conductor. Individual conductors shall be insulated with type, XHHW, THW, THHN/THWN 600-volt insulation unless otherwise noted. Control, signal, communication conductors shall be as dictated by the vendor of that equipment or as specified here-in. Proper insulation type shall be used for the proper environmental application (i.e., waterproof, wet location, plenum, temperature rated). If a condition exists where the application is uncertain, contact the Engineer for direction. Contractor is responsible to follow specific cabling requirements described in other sections of this specification relative to various communications and controls systems as well as the respective riser diagrams shown on plans. If a discrepancy occurs, communicate such discrepancy to the Architect and Engineer immediately for resolution.

E. Insulation types THWN, THHN or XHHW. Minimum insulation rating of 90C for branch circuits.

F. Refer to signal and communications specification sections for cable requirements.

2.3 CONNECTORS

A. Copper Pads: Drilled and tapped for multiple conductor terminals.

B. Lugs: Indent/compression type for use with stranded branch circuit or control conductors.

C. Solid Conductor Branch Circuits: Spring connectors, wire nuts, for conductors 18 through 8AWG.

2.4 LUGS AND PADS

A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation: Conductors shall not be installed until after conduit systems are permanently in place. Use an approved non hardening type wire pulling lubricant if lubricant is to be used. Maintain all conduits and wire pulls free from foreign material. If due to field conditions, more than a total of 300 degrees of bend are required; a pull box shall be furnished and installed for ease of installation. Said pull boxes must be sized and rated for the appropriate application and must remain easily accessible upon completion of the project (approval of the location shall be obtained from the Architect prior to installation). Show these pullboxes on the field record drawings. Conductors installed in underground raceways on site shall be duct sealed and taped where they exit the raceway to prevent the entrance of foreign material and moisture after the conductors are installed. Proper drainage shall be provided for underground pull and splice boxes.

B. Insulation: Use proper insulation types where temperature and environment are a factor.

C. Splices at or below grade level shall be made with wet location rated and approved mechanical connectors and shall be encapsulated in epoxy or plastic molded poured kits. The connections must be assured to be watertight. Splices at or below grade shall always be avoided and minimized. Prior approval is required for feeder splices below grade. Submit proposed materials and exhibit showing location of intended splices for Engineer’s review and approval prior to commencing with the work.

D. Labeling: All conductors in panels, switchboards, terminal cabinets, vaults, pull boxes, and junction boxes shall be labeled with tape number markers indicating circuit number and identifying system. All labeling shall be permanent. In manholes and vaults, provide embossed

brass tags identifying system serviced and function. See Section 26 05 53 IDENTIFICATION OF ELECTRICAL SYSTEMS.

E. All conductors, wiring, cable where installed below floor, slab or underground shall be considered wet locations, and shall be rated accordingly. Non waterproof cabling is not allowed in any below grade or wet application.

F. Cables routed together in cable tray shall be stacked, organized and tie wrapped together in a neat and workman like manner. Random cable routing is not acceptable.

G. Cable and conductors routed through pull boxes and vaults shall be properly supported on porcelain or equal insulators mounted on steel rack inserts. Bend radius of cable or conductor shall not be less than six times the overall cable diameter.

H. Wires and Cables:
   1. Conductor Installation:
      a. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
      b. Install conductors with care to avoid damage to insulation.
      c. Do not apply greater tension on conductors than recommended by manufacturer during installation.
      d. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation.
   2. Conductor Size and Quantity:
      a. Install no conductors smaller than 12AWG unless otherwise shown.
      b. Provide all required conductors for a fully operable system.
   3. Provide dedicated neutrals (one neutral conductor for each phase conductor) in the following single phase circuits:
      a. Dimmer controlled circuits.
      b. Isolated ground circuits.
      c. Ground fault and arc fault protected circuits where a GFI and arc fault breakers are used in panelboards.
      d. Other electronic equipment which produces a high level of harmonic distortion including but not limited to computers, printers, plotters, copy machines, fax machines, where indicated.
   4. Conductors in Cabinets:
      a. Cable and train all wires in panels and cabinets for power and control neatly and uniformly. Use plastic ties in panels and cabinets.
      b. Tie and bundle feeder conductors in wireways of panelboards.
      c. Hold conductors away from sharp metal edges.
      d. Connectors: Retighten mechanical type lugs and connectors for conductors to equipment prior to Notice of Completion.

END OF SECTION

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Grounding and bonding requirements of electrical installations for personnel safety and to provide a low impedance path for possible ground fault currents as described in CEC Article 250.
   2. “Grounding electrode system” refers to all electrodes required by CEC, as well as including made, supplementary, lightning protection system and telecommunications system grounding electrodes.
   3. The terms “connect” and “bond” are used interchangeably in this specification and have the same meaning.

B. Related Work:
   1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be permitted to be identified per CEC.

B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG and smaller shall be ASTM B1 solid bare copper wire.

C. Conductor sizes shall not be less than what is shown on the drawings and not less than required by the CEC, whichever is greater.

2.2 GROUND RODS

A. Copperclad steel, 3/4" diameter by 10’ long, conforming to UL 467 unless otherwise noted on drawings and details.

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B. Quantity of rods shall be as required to obtain the specified ground resistance or additional rods shall be driven to obtain specified resistance or less.

2.3 SPLICES AND TERMINATION COMPONENTS

A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

PART 3 - EXECUTION

3.1 GENERAL

A. Ground in accordance with the CEC, as shown on drawings, and as hereinafter specified.

B. System Grounding:
   1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
   2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, fire sprinklers, plumbing piping, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.3 SECONDARY EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

B. Metallic Piping, Building Steel, and Supplemental Electrode(s):
   1. Provide a grounding electrode conductor sized per CEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
   2. Provide a supplemental ground electrode and bond to the grounding electrode system.

C. Service Disconnect: Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.

D. Switchgear, Switchboards, Unit Substations, and Motor Control Centers:

1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
2. For service entrance equipment, connect the grounding electrode conductor to the ground bus.
3. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.

E. Transformers:
1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to nearest component of the grounding electrode system and the ground bar at the service equipment.

F. Conduit Systems:
1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor sized per CEC.
2. Non metallic conduit systems shall contain an equipment grounding conductor.
3. Metal conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

G. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, power and lighting branch circuits.

H. Boxes, Cabinets, Enclosures, and Panelboards:
1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes.
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

I. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.

J. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

K. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

L. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

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3.4 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.5 TELECOMMUNICATIONS SYSTEM

A. Bond telecommunications system grounding equipment to the electrical grounding electrode system. Refer to Section 27 13 00, INTERCOMMUNICATIONS SYSTEMS.

3.6 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 25 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Owner. Final tests shall assure that this requirement is met and test results shall be submitted to the Owner with final close out documents.

B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE Standard 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Below-grade connections shall be visually inspected by the IOR prior to backfilling. The Contractor shall notify the IOR 24 hours before the connections are ready for inspection.

D. Furnish a copy of tests to Owner at completion of project.

3.7 GROUND ROD INSTALLATION

A. Drive each rod vertically in the earth, not less than 8’ in depth.

B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.

C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

3.8 GROUNDING FOR RF/EMI CONTROL

A. Install bonding jumpers to bond all conduit, cable trays, sleeves and equipment for low voltage signaling and data communications circuits. Bonding jumpers shall consist of 4” wide copper strip or two No. 10 copper conductors spaced minimum 4” apart. Use No. 6 copper where exposed and subject to damage.

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B. Comply with the following when shielded cable is used for communication circuits.
   1. Shields shall be continuous throughout each circuit.
   2. Connect shield drain wires together at each circuit connection point and insulate from ground. Do not ground the shield.
   3. Do not connect shields from different circuits together.
   4. Shield shall be connected at one end only. Connect shield to signal reference at the origin of the circuit. Consult with equipment manufacturer to determine signal reference.

END OF SECTION

SECTION 26 05 33 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Conduit and fittings.
2. Outlet boxes.
3. Weatherproof outlet boxes.
4. Junction and pull boxes.
5. Floor boxes.
6. Service Fittings.
7. Cabinets, termination cabinets.
8. Gutters.
9. Concrete boxes and vaults.

B. Related Work:
1. Installation of all wire, cable, conductor, boxes/gutters, pull ropes, fiber optic cable raceway, conduit, innerduct, cable sleeve and duct as described on the plans and/or as specified here-in. This scope shall include pathways to be installed underground on site and offsite, underslab, above grade, both concealed and exposed, overhead concealed and exposed as appropriately applied. Raceways/boxes shall be installed in accordance with their intended and allowed uses and as specified here-in whichever is more restrictive. Size and capacity of all raceway/boxes shall be as specified here-in or as depicted on the drawings, but shall not be less than that required by code. Larger raceway sizes may be specified than code would permit. The specifications shall govern.
2. Listed products for termination, coupling, extending, benching supports of raceways shall be used.
3. Raceways/boxes described by this section shall include, but not be limited to, power for site utilities and lighting, site and building communications, controls, fire alarm, security, access control, sound systems, data system, energy management systems, power distribution, lighting, lighting controls, video, CATV, voice communications, intercom, HVAC and other building low voltage/communications systems controls as may be required. Raceways, boxes and duct paths required for utility companies shall be installed per plans unless utility company requirements are more restrictive at which time those requirements shall take precedence.
4. Protection of and cleanliness of pathways and raceways must be assured during the construction process in order to eliminate the possibility of debris entering the conduit, duct, pathway resulting in decreased wire capacity and potential damage to installed conductors and cables.

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5. Pathways are shown in a diagrammatic way and are generally accurate as to routing, however, it is the Contractor's responsibility as a means and methods process to coordinate with all other trades that require space within a building. The Contractor shall obtain approval for installation of raceways routing through structural footings, retaining walls, columns, beams, purlins, grade beams, etc.
6. It is the Contractor's responsibility to ensure that all raceway and boxes systems penetrate fire assemblies and sound rated assemblies in an approved manner using the appropriate and listed products for the purpose.
7. Trenching and backfilling for all underground conduit systems installed by the Electrical Contractor shall be the responsibility of the Contractor. Conduits shall have minimum cover requirement of 36" below finish grade with the exception of site lighting conduits which may be 24" below finish grade minimum. More stringent depth requirements may be imposed by the local agency and utility company and shall be adhered to, and / or this specification or as detailed on the plans. Joint trenching may be utilized where practicable and where permitted by this specification. Concrete, native material and sand shall be used as backfill material and shall be compacted in accordance with and coordinated with the grading and site preparation requirements. Conduits shall rest in a minimum of 4" bed of sand prior to backfill and compaction. Locations of existing underground (UG) utility systems shall be determined by calling Underground Service Alert (USA) at least 48 hours prior to any excavation. Also refer to Section 26 05 46.13, ELECTRIC UTILITY SYSTEMS.
8. Minimum conduit size shall be 1/2" except if plan shows or code requires larger size. Exception: Use minimum 3/4" for underslab and below grade applications outside of building exterior walls.
9. All electrical, control, communications systems shall be installed in metallic conduit system. This shall include but not be limited to all systems described in Section B.3 above, except for voice and data systems which shall be installed as described on these plans and as specified here-in but shall not be less than the recommendations of EIA/TIA standards.
10. All line voltage wiring within the building shall be installed in metallic conduit.
11. All conduit, concrete pads, underground concrete or fiberglass substructures shall be furnished and installed with the approved materials and type for the application. Provide proper traffic control during construction as well as barriers and protection of all excavations and trenching.
12. Empty or future conduits shall be properly plugged with plastic caps or inserts with a 3/8" polyethylene pull rope. Plastic or "duct" tape will not be acceptable.
13. Exterior installations: After conductors are installed, seal conduit ends to prevent entrance of foreign material using pliable duct seal, caps or waterproof expanding foam.
14. All low voltage systems including intercom, fire alarm, public address, etc. shall be in dedicated conduit systems. Voice / Data and Direct Digital Control (DDC) systems for HVAC cabling shall be routed as specified in Section 27 13 00, INTERCOMMUNICATIONS SYSTEMS and as recommended by EIA/TIA standards. It shall be the contractor's responsibility to provide raceway down walls to outlet boxes and to provide sleeves across inaccessible ceiling spaces.
15. Underground conduits entering building shall have the open end of conduit within building above the elevation of the conduit outside the building such that water cannot enter building through conduit. If such a condition exists, a pull box outside of building footprint shall be installed in conduit route before conduit enters building whereby top of pull box is below finish floor of building and moisture may exit box before entering building.

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16. No single conduit run of any type shall exceed 300 degrees of radius bend from termination box to termination box.
17. Separate Raceway System: Provide a separate dedicated raceway system for each system installed, do not combine different systems into a raceway or cable tray system, unless otherwise noted or allowed.
18. Spare, Future Conduits: Conduits labeled conduit only, spare, or for future use, shall be provided with a pullrope, capped at each end, labeled as spare with destination marked, and turned over to the Owner in an unused state. Contractor shall not utilize these conduits for the installation of cabling or conductors as part of this scope of work. Contractor to verify and install at no additional cost to the Owner, additional conduits as required for the installation of the systems being installed.
19. Outlet System: Provide electrical boxes and fittings as required for a complete installation. Including but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts, covers and all other necessary components.
20. Code Compliance: Comply with CEC as applicable to construction and installation of electrical boxes and fittings and size boxes according to CEC 312, 314 and 366 except as noted otherwise.
21. Outlets to be flush mounted: Maintain integrity of insulation and vapor barrier. Unless otherwise noted, flush mount all outlet boxes.
22. Provide putty pads of proper type around outlet boxes and/or as detailed on plan to meet sound transmission restrictions and fire ratings of walls. Refer to Architectural for locations.

1.3 SUBMITTALS

A. Provide Shop Drawings and Product Data for the Following Equipment:
1. Conduit and fittings.
2. Outlet boxes.
3. Weatherproof outlet boxes.
4. Junction and pull boxes.
5. Floor boxes.
6. Service Fittings.
7. Cabinets, termination cabinets.
8. Gutters.
9. Concrete boxes and vaults.
10. Putty pads, sound pads.
11. Raceways

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs.

B. Furnish products listed by UL or other independent and nationally recognized testing firm.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Heavy wall Rigid Non-Metallic Conduit, shall be PVC schedule 40 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.

B. Extra heavy wall non-metallic conduit, shall be PVC schedule 80 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.

C. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.

D. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.

E. Flexible Metal Conduit (FMC) shall be continuous wound reduced wall galvanized steel produced to UL standards.

F. Liquid tight flexible metal conduit shall have a thermoplastic cover over a galvanized steel core containing an integral copper ground in sizes to 1 1/4" and shall be in compliance with UL standards and CEC Article 350.

G. Wire basket tray shall be minimum dimensions as shown on associated Telecommunications Drawings, unless otherwise noted. It shall be U.L. listed and use listed connectors, elbows, tees, etc. and be cut and installed using listed equipment. Material shall be zinc electroplated steel.

H. Cable runway tray (ladder tray) shall be min. 12” wide with 1-1/2” side rails unless otherwise noted. Refer to associated Telecommunications Drawings. It shall be U.L. listed and use listed connectors, elbows, tees, etc. Material shall be hollow steel with gray painted finish. Refer to associated telecommunications drawings for specifics.

I. Manufacturers:
   1. Outlet Boxes: Bowers, Raco, Steel City or equal.
   2. Telecom Work Area Outlet Boxes - Randl 5-Square
   3. Weatherproof Outlet Boxes: Bell, Red Dot, [Carlon] or equal.
   4. Floor Boxes: Wiremold/Walker, Hubbell, Steel City, or equal.
   5. Junction and Pull Boxes: Circle AW, Hoffman, Wireguard or equal.
   6. Box Extension Adapter: Bell, Red Dot, [Carlon] or equal.
   7. Conduit Fittings: O-Z Gedney, Thomas & Betts, or equal.
   8. Vaults: Christy, Brooks, Utility Vault or equal.
   9. Putty pads, sound pads: 3M, Hilti, or equal.
   10. Heavy wall rigid non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
   11. Extra heavy wall non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
   12. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.

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13. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.
14. Flexible Metal Conduit (FMC), Alflex, American Flexible Conduit or equal.
15. Liquid tight flexible metal conduit, Anacanda (type UA), Electri-flex Liquatite or equal.
16. Wire basket tray, B-line, GS Metals, Cablofil or equal.
17. Cable runway tray, B-line, CPI, Homaco or equal.
18. Floor Boxes, Single Gang, Legrand (Wiremold/Walker) or approved equal.
19. Floor Boxes, Multiple Gang, Legrand Walker/Wiremold EFB Series or RFB Series with cover, carpet plates, and/or water-resistant device covers.
20. Electrical Service Fittings (Table-Top Device box). Lab Furniture & Fume Hood Company, Legrand (Wiremold) or approved equal.
21. Masonry Boxes, outlets in concrete, Raco Series 690 or equal.
22. Floor Boxes, Legrand (Walker/Wiremold) multi-service device or single service device, or approved equal unless otherwise noted.
23. Floor Boxes, (with devices and or/ furniture feed) Legrand (Walker/Wiremold) Evolution Series or approved equal.
24. Exterior In-Grade Boxes for Non-Utility Company, Precast concrete or polymer concrete, Utility Vault and Christy.

2.2 OUTLET BOXES

A. NEMA 1 gutter, junction and pull boxes shall be fabricated from code gage steel finished in grey enamel with screw cover fronts and concentric knockouts in all sides.

B. NEMA 3R gutter, junction and pull boxes shall be fabricated from code gage galvanized steel with screw cover fronts and concentric knockouts in the bottom only. Any penetrations to the side, top or back shall be weatherproofed in an approved manner such as “MYERS” gasketed type hub or equal.

C. Steel outlet boxes and plaster rings shall be galvanized rigid assemblies, either one piece pressed or factory welded construction containing the size and number of knockouts required. Steel outlet boxes shall be manufactured, sized and installed in accordance with CEC Article 314. Device Outlet: Installation of one or two devices at common location, minimum 4” square, minimum 1 1/2" deep. Single or 2 gang flush device plaster ring. Raco Series 681 and 686 or equal.

D. Luminaire Outlet: minimum 4” square with correct plaster ring depth, minimum 1 1/2” deep with 3/8” luminaire stud if required. Provide proper depth plaster ring on bracket outlets and on ceiling outlets.

E. Multiple Devices: Three or more devices at common location. Install 1 piece gang boxes with 1 piece device plastering. Install one device per gang unless otherwise allowed.

F. Construction: Provide galvanized steel interior outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Boxes shall be properly secured to the structure such that they are flush with the finish surface. Boxes shall be made structurally secure by means of the proper fastening devices.

G. Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, plaster rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

2.3 WEATHERPROOF OUTLET BOXES

A. Surface mounted die cast aluminum device boxes shall be provided with screw holes to accommodate cast device covers.

B. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner. Weatherproof boxes in wet locations as described in CEC 406.8 (B) shall be provided with a “while-in-use” cover; red dot ‘CK’ Series of aluminum die-cast construction, NEMA 3R, with lacquer finish.

2.4 JUNCTION AND PULL BOXES

A. Construction: Provide galvanized sheet steel junction and pull boxes, with screw-on covers; of the type shape and size, to suit each respective location and installation; with welded seams and equipped with steel nuts, bolts, screws and washers.

B. Location:
1. Install junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
2. Install junction boxes and pull boxes as required to facilitate the installation of conductors and limiting the accumulated angular sum of bends between boxes, cabinets and appliances to 300 degrees.
3. Locations: Junction boxes shall be located only where necessary and only in equipment rooms, closets, and accessible attic and underfloor spaces. A horizontal distance of 24” shall separate outlet boxes on opposite sides of occupancy separation walls, fire-rated walls or partitions.
4. Labeling: Junction box covers shall be marked with indelible ink indicated the circuit numbers passing through the box.

2.5 BOX EXTENSION ADAPTER

A. Construction: Diecast aluminum with gasket.

B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment.

2.6 CONDUIT FITTINGS

A. Requirements: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and plastic conduit bushings of the type and size to suit each respective use and installation.

B. Steel boxes may allow for field knock-out modifications, but shall in all other ways conform to code requirements.

2.7 FLOOR BOXES - SINGLE GANG

A. Construction: Deep cast iron fully adjustable before and after concrete pour with all required components for complete activation. Verify required components for application of service fittings, covers, monuments, and the like, attached to floor boxes.

B. Activations:
1. Flush: Provide brass duplex or single signal cover, hinged with set screw lock. Carpet or tile finish ring.
2. Monuments: Provide stainless steel monuments with power receptacle or data grommet as noted.
3. Coordinate specific application of systems as noted on Drawings.

C. Plastic floor boxes which glue together will not be considered. Plastic mechanically assembled floor boxes may be considered with prior approval.

D. Location: Concrete floor. Use poke-thru of same construction in non-concrete structure. Verify exact locations. Ensure flush with finish surface.

E. Steel floor box construction will be allowed only at upper levels of buildings not at slab on grade level. Boxes in slab on grade application shall be listed for the application.

2.8 FLOOR BOXES - MULTIPLE GANG

A. Construction: Deep cast iron, fully adjustable before and after pour. Equal to Legrand Walker/Wiremold EFB or RFB Series multi-service floor box with carpet plates, and/or water resistant device covers. Verify cover color. Partition for different power or signal applications. Provide required power receptacle devices and signal grommets or receptacles as noted. Flange type shall be compatible with floor covering for either carpet or vinyl as required and shall be brass type not polycarbonate.

B. Floor mounted boxes shall be water tight and cast iron (or epoxy coated) when installed in grade level concrete slab floor, fully adjustable with interior and exterior leveling screws. Receptacle flange shall be brass with a duplex lift lid. Flange type shall be compatible with floor type. Before installation, coordinate exact location with Architect.

2.9 SERVICE FITTINGS

A. Die cast Aluminum with satin finish. Number of opening (gangs) and devices as shown on associated electrical drawings.

B. Provide as complete unit with faceplates, baseplate, etc.

C. Coordinate requirements with Furnishings section(s).

D. Basis of design manufacturer: Lab Furniture and Fume Hoods (LFFH). Satin aluminum finish.

2.10 EXTERIOR IN-GRADE BOXES FOR NON-UTILITY COMPANY USE SHALL BE:

A. Precast concrete or polymer concrete type with full bottoms and draining into gravel drywell. . Open bottom splice/pull boxes 24” x 36” and smaller shall be open bottom, with minimum 12” of gravel below for drainage.

B. Flushmount in hardscape and 1” above grade in softscape.

C. Provided with correct traffic type lid, i.e., full vehicular, intermediate incidental vehicular or pedestrian-rated as applicable stamped with “ELECTRIC”, “LIGHTING”, COMMUNICATIONS”, etc. cover identification as shown on the drawings or as applicable. All boxes or vaults located in streets, driveways, sidewalks wider than 8’, and turf areas where mowing takes place shall be traffic rated.

D. Provided with brass hold-down bolts in cover.

E. Provided with necessary box extensions to gain proper depth.

F. Seal all conduit in underground boxes with duct seal after conductors have been installed.

2.11 PUTTY PADS

A. Intumescent moldable firestop putty designed to protect electrical outlet boxes.

B. Designed to install around outside of outlet boxes.

C. May be used to obtain wall sound rating (STC) requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Conduit systems listed below are for use in installations where they are permitted to be used by CEC and/or other occupancy restrictions. The below installation methods do not intend to suggest that these materials be installed in conflict with any applicable code. Special attention to applications shall be made in building types such as Educational, Health Care, wet location, hazardous locations, assembly occupancy and multi-story, but not limited to these. Requirements which are more restrictive than the CEC may be called for by the drawings and / or these specifications. These requirements must be adhered to. The Electrical Contractor shall be responsible to use the proper conduit system for the application. Exposed conduit is not allowed below ceilings or above slab of floor, without the permission and approval of the Architect. All conduits shall be concealed except in electrical and telecommunication rooms or where shown to be surface mounted. Exposed conduit (where allowed) shall be run square and plumb with building lines in an approved manner. Support roofmount conduits, where allowed, with minimum 12” wide blocks set in mastic unless otherwise detailed in roof requirements or as specified in roofing specification, by the Architect. Strap conduits to blocks with proper sized conduit straps. Spacing of support shall be a minimum as provided for in the CEC. All exposed conduit mounted below 8’ above finished grade shall be strapped at a minimum of 5’ spacing.

B. Non-Metallic Rigid Conduit shall be used in concrete slabs, below concrete slabs on grade, or underground outside of a building slab or foundation. Maintain minimum depth requirements and cover with appropriate fill material. Minimum 4” of bedding and cover of backfill material 1/4" size grain and smaller maximum. Conduit shall be heavy wall Schedule 40 or 80, rigid PVC only. Rigid utility P&C duct shall not be used in any application. Properly sized grounding conductors shall be installed per CEC article 250, in all non-metallic conduit branch circuit and feeder runs. PVC conduit shall be formed or field bent only with the use of properly approved bending tools such as to not decrease the internal bore of the conduit. All conduits shall be cut square and reamed of burrs. Approved and compatible glue shall be used on all PVC fittings to attain watertight joints. All non-metallic conduit runs over 150’ in length and over 1 1/4" trade size conduit shall utilize galvanized rigid steel elbows.

C. Galvanized Rigid Steel (GRS) conduit shall be used where exposed less than 8’–0” above finished grade to 18” below finished grade and where subject to physical damage. Conduits shall be cut square and reamed to remove burrs and sharp edges. Strap conduit below 8’ above grade at 5’ intervals. Unless otherwise noted, threadless setscrew and threadless weathertight fittings may be used in lieu of threaded fittings. All threaded ends entering a junction box of any type shall require one locknut on the inside and one on the outside of the enclosure and be provided with a plastic bushing or grounding bushing where necessary for proper grounding. Where exposed to moisture, a watertight hub or other approved method shall be required. All conduits shall be stubbed up straight and uniform into junction boxes, panels, cabinets, etc., and shall be (GRS) properly supported and strapped. All GRS conduit located below grade, shall be tape wrapped.

D. Electrical Metallic Tubing (EMT) shall be used as allowed by code and as permitted by this specification. It shall not be in contact with soil or the concrete slab on the ground floor of any structure. Connectors and couplings shall be steel insulated set screw type where installed in indoor dry locations not subject to moisture. Where the potential for moisture is present, compression type weathertight fittings are required. One hole conduit straps are permitted from 1/2" to 1” and two hole conduit straps are required for size 1 1/4” and larger. EMT shall not be allowed in areas subject to severe physical damage. Install copper ground wire sized per CEC 250-122 in all EMT conduits.

E. Flexible conduit may be used where concealed in building construction or above dropped ceilings, but shall meet the following criteria: No individual circuit path from distribution panel to last device shall exceed a cumulative length of 30’ of flexible conduit from start to end. Flexible conduit shall not exceed a total directional change of 270 bending degrees in any one run between conduit terminations. Squeeze type or Jake type steel flex fittings of a grounding type are required. Flexible conduit must be supported in accordance with CEC. Where exposed to the weather, moisture, or spray down flexible conduit shall be of the liquidtight type. Fittings shall be manufactured for use with liquidtight flexible conduit. All motor connections shall be made with liquidtight flex. Flexible conduit may not be used where exposed except for last 2’ of equipment connection and unless otherwise noted or approved. A copper ground wire sized per CEC 250-122 shall be installed in all flexible conduit runs. Flexible conduit may not be used exposed. Weatherproof liquid tight conduit shall not be used at roof level for equipment connections with lengths exceeding 24” nor shall it be used to circumvent a rigid conduit system in a horizontal direction. Connect recessed lighting fixtures to conduit runs with a maximum of 6’ of flexible metal conduit extending from junction box to fixture.

F. Underground conduits and transition to above grade/slab shall be as follows:

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1. PVC elbows allowed if top of elbow is minimum 18” BFG or below top of slab, otherwise GRS elbows are required.
2. GRS elbows are required if conduit run is 150’ or greater.
3. GRS risers are required from elbow below grade to equipment (device, outlet, panel, cabinet, etc.) above grade.
4. GRS elbows/risers to be PVC coated or 10 MIL taped wrapped (1/2” lapped) to 3” above finish grade or top of slab.

G. Conduit Supports: Conduit runs may be supported by one-hole and two-hole straps or supports as manufactured by Unistrut, Minerallac, Caddy or equals. Supports may be fastened by means of anchors, shields, beam clamps, toggle bolts, or other approved methods appropriate for the application and size of conduit. Pipe nailers (J-hooks) may only be used for 1” conduit and smaller and only in wood frame construction. Conduit support methods are subject to review by the engineer and authority having jurisdiction for adequacy. Installations deemed inadequate shall be corrected by the contractor at no cost to the Owner.

H. Bends and offsets shall be made with approved tools for the type of conduit being utilized. Bends shall be made without kinking or destroying the smooth bore of the conduit. Parallel conduits shall be run straight and true with bends uniform and symmetrical. Minimum radii shall be per CEC 344-24.

I. Conduit Stub-outs below grade shall be capped with plastic cap, and identified by placing a pull box marked with correctly identified utility such as “Elec”, “Tel”, etc. Dimension for exact location on field record drawings. Provide lids for proper field application (i.e. traffic, incidental, pedestrian).

J. Conduit Seals: Where below grade conduits enter structure through slab or retaining wall of building or basement, seal the inside of each conduit as follows:
1. Provide damming material around conductors 3” into conduit.
2. Fill 3” of conduit with 3M #2123 sealing compound.
3. Wrap conductors where they exit the conduit with 3M #2229 "Scotch Seal" mastic tape. Lap tape to approximate diameter of the raceway and wrap outside of conduit opening with (minimum) one turn.
4. Use conduit sealing bushings type CSB (O-Z/Gedney) or equal.
5. Empty conduits shall be sealed with standard non-hardening duct seal compound and then capped to prevent entrance of moisture and gases and to meet fire resistance requirements.
6. Provide cable drip loop minimum 12” high.

K. Marker tape: Place plastic yellow marker tape at 12” above buried conduits. Label tape "CAUTION: ELECTRICAL LINES BELOW" or similar wording.

L. Conduits for high voltage (12kv) systems shall be separated from all other conduits by a minimum of 12”. All power system conduits shall be separated from low voltage systems by a minimum of 12” when running parallel to each other and no less than 6” when running perpendicular to each other at conduit crossings.

M. Medium voltage system conduits including 4,000 volt and above, shall be installed in conduit systems or duct banks that are concrete encased by a minimum of 3” of concrete. Depth of conduits shall remain as specified elsewhere in this specification or as required by the CEC.

N. Electrical and communications systems raceways routed underground shall not occupy the same trench as plumbing utilities such as sewer, water, storm drain, gas or other wet or dry gaseous utility system. A minimum of 12" of undisturbed earth is required. Where utilities must cross in closer proximity to each other due to physical constraints, 6" minimum crossing distances are allowed, however 18" on all sides of a utility crossing must be concrete encased.

O. Duct bank defined here-in shall be four or more conduits in a common trench, conduit spacers and saddles shall be required in all trenches where more than two conduits over 2" in diameter travel in the same trench. Proper spacing between systems as outlined above shall be required and spacers shall be located each 5' (maximum) along trench route from point to point.

P. Conduits, routed below footings, slabs, grade beams, columns, and other structural elements shall be installed in strict compliance with structural details and criteria shown on structural plans. Clearances below structural elements and sleeves through structural elements must be carefully planned to avoid conflict and must be approved by the structural engineer if conflict arises.

Q. All conduit or raceways passing through fire rated walls, floors, or ceilings shall be installed with a listed penetration method which protects the opening to the same rating as the assembly and is non hardening.

R. Expansion Joints
1. Conduits 3" and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
2. Provide conduits smaller than 3" with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5" vertical drop midway between the end. All conduit shall have a copper green grounding bonding conductor installed.

S. Seismic Joints
1. At seismic joints, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes or approved fittings, on both sides of the joint. Connect conduits to junction boxes with sufficient slack flexible conduit such that these slack conduits are 1 1/2 times the distance between conduit ends. Flexible conduit shall have a copper green ground bonding jumper installed.

T. Interior, in-wall and ceiling telecommunications outlet boxes shall have (1) 1-1/4" EMT conduit stub to nearest accessible ceiling.

U. Cable Runway (Ladder tray) shall be used in equipment rooms where shown on the plans. Ladder tray installations shall conform to the requirements of CEC Article 318. The contractor shall provide all mounting hardware, connectors and bracing as required and as recommended by the manufacturer for a complete system installation.

V. Wire basket tray shall be used in all concealed spaces (above ceiling spaces, under buildings in access tunnels, below raised floors, etc.) unless otherwise noted. Wire basket tray installations shall conform to the requirements of CEC Article 318. The contractor shall provide all mounting hardware, connectors and bracing as required and as recommended by the manufacturer for a complete system installation. All cutting of wire basket tray shall be per the manufacturer's recommendation using tools designed for that purpose. Cable loading shall not

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exceed the listing of the system and its support. Provide a #6CU ground wire the length of all cable tray with bond with bond connection to communications room ground bus.

W. Location: Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.

X. Anchoring: Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.

Y. Special Application: Provide weatherproof outlets for locations exposed to weather or moisture.

Z. Knockout Closures: Provide knockout closures to cap unused knockout holes where blanks have been removed.

AA. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, the following distances above the finished floor:
1. Receptacles, Telephone, TV & Data outlets. (measured to bottom of outlet box): +15".
2. Outlet above counter (measured to top of outlet box): +46".
3. Control (light) Switches. (measured to top of outlet box): +48".
4. Fire Alarm Manual Pull Stations, T-stats. (measured to top of outlet box): +48".
5. Fire Alarm Visuals: the lower of +80" to bottom of lens, or 6" below ceiling.
6. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.

BB. Coordinate all electrical device locations with the architectural floor plan and interior and exterior elevations to prevent mounting devices within elements that they may conflict such as cabinetry, mirrors, planters, etc.

CC. Size outlet and junction boxes to minimum wire fill space requirements. Upsize box as required to allow ease of wire installation and device installation.

DD. Outlet and junction boxes in fire rated walls shall be gauged and spaced so as not to exceed the maximum penetration allowed by the assembly without compromising the fire rating. If a conflict arises relative to a specific condition, the contractor shall follow the requirements of the fire authority and ask for guidance from the design team. At no time should a larger box be installed prior to resolution of conflict.

END OF SECTION

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SECTION 26 05 53 – IDENTIFICATION OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Nameplates and warning signs where specified herein and as shown on contract documents including the following:
      a. Nameplates and warning signs permanently installed on all electrical equipment and devices including, but not limited to, the following items:
         1) Enclosures for transformers, switchboards, motor control, panels, pullboxes, cabinets, motors, generators, transfer switches.
         2) Enclosures for all separately enclosed devices including, but not limited to, disconnect switches, circuit breakers, contactors, time switches, control stations and relays, fire alarm panels and lighting control panel.
         3) Wall switches not within sight of outlet controlled.
         4) Special systems such as, but not limited to, telephone, fire alarm, warning and signal systems. Identification shall be at each equipment rack, terminal cabinet, control panel, annunciator and pullbox.
         5) Devices mounted within and part of equipment including circuit breakers, switches, control devices, control transformers, relays, indication devices and instruments.
   2. Conductor and Cable Identification.

B. Related Work:
   1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
   3. Section 26 13 00, MEDIUM VOLTAGE SWITCHGEAR (ABOVE 600 VOLTS).
   4. Section 26 13 02, SWITCHES, MEDIUM VOLTAGE (ABOVE 600 VOLTS).
   5. Section 26 24 16, PANELBOARDS.
   6. Section 26 28 16, ENCLOSED SWITCHES AND CIRCUIT BREAKERS.
   7. Section 26 12 00, MEDIUM VOLTAGE TRANSFORMERS.
   8. Section 26 2200 LOW VOLTAGE TRANSFORMERS.
   9. Section 26 24 14, DISTRIBUTION SWITCHBOARD.

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PART 2 - PRODUCTS

2.1 EQUIPMENT LABEL DESIGNATIONS

A. Equipment labels indicating equipment designations both emergency and normal. Designation data per drawings or to be supplied with shop drawings approval.

B. Panelboard labels showing panel designation, voltage, phase and source.

C. In accordance with CEC 110.16, provide arc flash protection warning labels on all switchboards, panelboards, distribution panels, transformers, safety switches, transfer equipment, etc. Labels shall be per ANSI Z535.4 guidelines.

2.2 MATERIALS

A. For Labels: Three layer laminated plastic or micarta with engraved white letters over black background.

B. For Emergency Equipment: Use engraved white letters over red background.

C. For Warning Signs: Minimum 18 gauge steel with red lettering on white porcelain enamel finish.

D. Arc flash labels shall be provided as required by CEC Article 70E.

E. Conductor tape number markers: ABB Thomas & Betts WM-0-45 Series non-fading permanent adhesive.

PART 3 - EXECUTION

3.1 MOUNTING

A. Equipment labels shall be mounted by self-tapping, threaded screws and bolts, or by rivets. Adhesive types are not acceptable unless specifically noted in this section.

B. Conductor tape markers shall be consistently placed for ready conductor identification. NOTE: Branch circuit neutral conductors as well as phase conductors shall be labeled with circuit number.

3.2 HEIGHTS ON LABELS

A. Panelboards, Switchboards and Motor Control Centers and Special Systems Enclosures: 1/4" identify equipment designation; 1/8” identify voltage rating and source.

B. Individual Circuit Breakers, Switches, and Motor Starters in Panelboards, Switchboards, and Motor Control Centers: 3/16” identify circuit and load served, including location of equipment.

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C. Enclosed Circuit Breakers, Enclosed Switches, and Motor Starters: 3/16” identify load served.

D. Transformers: 3/16” identify equipment designation; 1/8” identify primary and secondary voltages, primary source and secondary load. Include location of primary source or secondary load if remote from transformer.

3.3 WARNING SIGNS

A. Warning signs shall be permanently mounted with cadmium plated steel screws or nickel-plated brass bolts.

B. Warning signs to read "DANGER - HIGH VOLTAGE", with letters 1 1/2" high, 3/16” stroke minimum.

C. Provide warning sign on all doors or immediately next to door for equipment rooms, enclosures or closets containing equipment energized above 150 volts to ground as per CEC, and/or as directed by the Architect. For interior finish spaces and interior doors, signage shall be coordinated and approved with the Architect in advance of installation.

END OF SECTION

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SECTION 26 05 73 – OVERCURRENT PROTECTIVE DEVICE COORDINATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the requirements of the Overcurrent Protective Device Coordination.

B. A short circuit and coordination study shall be prepared for the electrical overcurrent devices to be installed under this project to assure selective coordination, proper equipment and personnel protection.

C. The study shall present an organized time current analysis of each protective device in series from the individual overcurrent device back to the utility and the on-site generator sources. The study shall reflect the operation of each device during normal and abnormal current conditions.

D. Implement as part of this contract, all manufacturer's recommendations for maximum protection and best selective coordination at no additional cost to Owner.

E. The Contractor shall furnish an ARC Flash analysis study per NFPA 70E – Standard For Electrical Safety In The Workplace, Reference Article 130.3 and Appendix D.

1.2 RELATED WORK

A. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Section 26 24 16, PANELBOARDS: Low voltage panelboards.

C. Section 26 12 00 MEDIUM VOLTAGE TRANSFORMER.

D. Section 26 2200 LOW VOLTAGE TRANSFORMERS.

E. Section 26 24 14, DISTRIBUTION SWITCHBOARDS: Low voltage distribution switchboards.

1.3 SUBMITTALS

A. In accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL, submit the following:
   1. Complete short circuit and coordination study as described herein.
   2. Protective equipment shop drawings shall be submitted simultaneously with or after the protective device study. Protective equipment shop drawings will not be accepted prior to protective device study.
   3. Certification: Two weeks prior to final inspection, submit four copies of the following to the Engineer:
      a. Certification by the Contractor that the protective devices have been adjusted and set in accordance with the approved protective device study.
      b. Final setting values for each adjustable trip device.

1.4 REFERENCES

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
6. IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations

B. American National Standards Institute (ANSI):
1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. The National Fire Protection Association (NFPA)
1. NFPA 70 - National Electrical Code, latest edition
2. NFPA 70E – Standard for Electrical Safety in the Workplace

1.5 QUALIFICATIONS

The protective device study shall be prepared by qualified engineers of the high voltage switchgear manufacturer or an approved consultant. The Contractor is responsible for providing all pertinent information required by the preparers to complete the study. Submit engineer’s qualifications with study.

1.6 REQUIREMENTS

A. The complete study shall include a system one line diagram, short circuit and ground fault analysis, and protective coordination plots.

B. One Line Diagram:
1. Show on the one line diagram, all electrical equipment and wiring to be protected by the overcurrent devices installed under this project. Clearly show, on the one line, the schematic wiring of the electrical distribution system.
2. Also show on the one line diagram the following specific information:
   a. Calculated fault impedance, X/R ratios, and short circuit values at each bus.
   b. Breaker and fuse ratings.
   c. Generator kW and Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.

d. Voltage at each bus.
e. Identification of each bus.
f. Conduit material, feeder sizes, length, and X/R ratios.

C. Short Circuit Study:
1. Systematically calculate the fault impedance to determine the available short circuit and ground fault currents at each bus. Incorporate the motor contribution in determining the momentary and interrupting ratings of the protective devices.
2. The study shall be calculated by means of a computer program. Pertinent data and the rationale employed in developing the calculations shall be incorporated in the introductory remarks of the study.
3. Present the data determined by the short circuit study in a table format. Include the following:
a. Device identification.
b. Operating voltage.
c. Protective device.
d. Device rating.

D. Calculated short circuit current.

E. Coordination Curves:
1. Prepare the coordination curves to determine the required settings of protective devices to assure selective coordination. Graphically illustrate on log paper that adequate time separation exists between series devices, including the utility company upstream device. Plot the specific time current characteristics of each protective device in such a manner that all upstream devices will be clearly depicted on one sheet.
2. The following specific information shall also be shown on the coordination curves:
a. Device identification.
b. Voltage and current ratio for curves.
c. 3-phase and 1-phase ANSI damage points for each transformer.
d. No damage, melting, and clearing curves for fuses.
e. Cable damage curves.
f. Transformer inrush points.
g. Maximum short circuit cutoff point.
3. Develop a table to summarize the settings selected for the protective devices. Include the following in the table:
a. Device identification.
b. Relay CT ratios, tap, time dial, and instantaneous pickup.
c. Circuit breaker sensor rating, long time, short time, and instantaneous settings, and time bands.
d. Fuse rating and type.
e. Ground fault pickup and time delay.

1.7 ANALYSIS

A. Analyze the short circuit calculations, and highlight any equipment that is determined to be underrated as specified. Propose approaches to effectively protect the underrated equipment.

B. After developing the coordination curves, highlight areas lacking coordination. Present a technical evaluation with a discussion of the logical compromises for best coordination.

1.8 ADJUSTMENTS, SETTINGS AND MODIFICATIONS

A. Necessary final field adjustments, settings and minor modifications shall be made to conform with the protective device study without additional cost to the Owner.

B. All final circuit breaker and relay settings and fuse sizes shall be made in accordance with the recommendations of the protective device study.

PART 2 - PRODUCTS

2.1 STUDIES

A. Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer or an approved consultant.

B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.

2.2 DATA COLLECTION

A. Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Source combination may include present and future motors and generators.

C. Load data utilized shall include proposed loads obtained from Contract Documents provided by Owner, or Contractor.

D. Include fault contribution of existing motors in the study, with motors greater than 25 hp. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.3 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVAULATION STUDY

A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standards 141-1993.

B. Transformer design impedances shall be used when test impedances are not available.

C. Provide the following:
1. Calculation methods and assumptions
2. Selected base per unit quantities
3. One-line diagram of the system being evaluated.

4. Source impedance data, including electric utility system and motor fault contribution characteristics.
5. Typical calculations
6. Tabulations of calculated quantities
7. Results, conclusions, and recommendations.

D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
1. Electric utility's supply termination point
2. Incoming switchgear
3. Unit substation primary and secondary terminals
4. Low voltage switchgear
5. Motor control centers
6. Standby generators and automatic transfer switches
7. Branch circuit panelboards
8. Other significant locations throughout the system.

E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.

F. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to short circuit ratings.
2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Adequacy of transformer windings to withstand short-circuit stresses.
4. Cable and busway sizes for ability to withstand short-circuit heating.
5. Notify Owner in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.

2.4 PROTECTIVE DEVICE COORDINATION STUDY

A. Proposed protective device coordination time-current curves shall be graphically displayed on log-log scale paper.

B. Include on each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.

D. Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the curve sheets, where applicable:
1. Electric utility's protective device
2. Medium voltage equipment relays
3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands

5. Transformer full-load current, magnetizing inrush current, and ANSI transformer withstand parameters
6. Conductor damage curves
7. Ground fault protective devices, as applicable
8. Pertinent motor starting characteristics and motor damage points
9. Pertinent generator short-circuit decrement curve and generator damage point
10. Other system load protective devices for the largest branch circuit and the largest feeder circuit breaker in each motor control center.

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

2.5 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.

B. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal.

C. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

D. The Arc-Flash Hazard Analysis shall include all significant locations in 208-volt systems fed from transformers equal to or greater than 45 kVA.

E. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm2.

F. The Arc Flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

G. Arc flash computation shall include both line and load side of main breaker calculations, where necessary.

H. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2.

2.6 REPORT SECTIONS

A. Input Data:
1. Short-circuit reactance of rotating machines
2. Cable and conduit materials
3. Bus ducts

4. Transformers
5. Reactors
6. Aerial lines
7. Circuit resistance and reactive values.

B. Short-Circuit Data:
1. Source fault impedance and generator contributions
2. X to R ratios
3. Asymmetry factors
4. Motor contributions
5. Short circuit kVA
6. Symmetrical and asymmetrical fault currents.

C. Recommended Protective Device Settings:
1. Phase and Ground Relays:
   a. Current transformer ratio
   b. Current setting
   c. Time setting
   d. Instantaneous setting
   e. Specialty non-overcurrent device settings
   f. Recommendations on improved relaying systems, if applicable.
2. Circuit Breakers:
   a. Adjustable pickups and time delays (long time, short time, ground)
   b. Adjustable time-current characteristic
   c. Adjustable instantaneous pickup
   d. Recommendations on improved trip systems, if applicable.

D. Incident energy and flash protection boundary calculations
1. Arcing fault magnitude
2. Device clearing time
3. Duration of arc
4. Arc flash boundary
5. Working distance
6. Incident energy
7. Hazard Risk Category
8. Recommendations for arc flash energy reduction

PART 3 - EXECUTION

3.1 EQUIPMENT AND FIELD ADJUSTMENTS

A. Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies and include all recommendations.

C. Following completion of all studies, acceptance testing and startup by the field engineering service division of the equipment manufacturer, a 2-year warranty shall be provided on all components manufactured by the engineering service parent manufacturing company.

3.2 ARC FLASH WARNING LABELS

A. The Contractor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed; a sample is included in this specification.

B. The label shall have an orange header with the wording, “WARNING, ARC FLASH HAZARD”, and shall include the following information:
1. Location designation
2. Nominal voltage
3. Flash protection boundary
4. Hazard risk category
5. Incident energy
6. Working distance
7. Engineering report number, revision number and issue date.

C. Labels shall be machine printed, with no field markings.

D. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
1. For each 600, 480 and applicable 208-volt panelboards, one arc flash label shall be provided.
2. For each motor control center, one arc flash label shall be provided.
3. For each low voltage switchboard, one arc flash label shall be provided.
4. For each switchgear, one flash label shall be provided.
5. For medium voltage switches one arc flash label shall be provided

E. Labels shall be field installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

3.3 ARC FLASH TRAINING

A. The equipment vendor shall train personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). Maintenance procedures in accordance with the requirements of NFPA 70E, Standard for Electrical Safety Requirements For Employee Workplaces, shall be provided in the equipment manuals. The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET).

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WARNING
ARC FLASH HAZARD
LABEL # 0001
LINE SIDE of MAIN
FLASH PROTECTION BOUNDARY: 40 inches
HAZARD RISK CATEGORY: CLASS 2
INCIDENT ENERGY RANGE: 4 – 8 cal/cm^2
LOAD SIDE of MAIN
FLASH PROTECTION BOUNDARY: 20 inches
HAZARD RISK CATEGORY: CLASS 0
INCIDENT ENERGY RANGE: 0 – 2 cal/cm^2
PSE TQS#: ####.#
Date Issued: April 2004
Study Rev.: 0
LOCATION: BUS NAME
PROTECTIVE DEVICE: UPSTREAM DEVICE

SECTION 26 09 23 - OCCUPANCY SENSORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Work:
1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
4. Section 26 27 26, WIRING DEVICES.
5. Section 26 56 70, LIGHTING ACCEPTANCE TESTING.

1.2 SYSTEM DESCRIPTION

A. The occupancy sensors shall sense the presence of human activity within the desired space and enable or disable the on/off manual lighting control function provided by local switches.

B. Upon detection of human activity by the detector, initiate a time delay to maintain the lights on for a preset period of time. Field adjustable time delay setting from 30 seconds to 15 minutes.

C. Sensors shall have factory set PIR sensing sensitivity for maximum sensitivity. Provide time delay at 10 minutes.

D. Install system in accordance with manufacturer's recommendations and instructions.

E. All line voltage sensors, control units, and relays UL listed

1.3 SUBMITTALS

A. Provide, on reproducible architectural floor plan, a layout of sensors indicating their sensing distribution.

B. Provide wiring diagrams indicating low voltage and line voltage wiring requirements.

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PART 2 - PRODUCTS

2.1 PASSIVE INFRARED SENSORS - GENERAL

A. The passive infrared sensors shall detect presence, in the floor area being controlled, by detecting changes in the Infrared energy. Detect small movements, i.e., when a person is writing while seated at a desk.

B. Provide a temperature compensated dual element sensor and a multi element fresnel lens.

C. The sensor shall utilize DIP switch adjustments for "on" mode operation, time delay, and sensitivity.

D. Provide a daylight filter which ensures that the sensor is insensitive to short-wavelength infrared waves, i.e., those emitted by the sun.

E. The sensors not to protrude more than 1 1/2" from the wall or ceiling and should blend in aesthetically.

F. Conceal adjustments and mounting hardware under a removable cover to prevent tampering with adjustments and hardware.

G. Low Voltage Sensors:
1. Sensor shall provide complete coverage of the controlled area.
2. Sensors shall operate on 24VDC power.
3. Sensors shall operate remote power switch packs.
4. Sensors can be wired in parallel to allow coverage of large areas.
5. Manufacturers: Sensor Switch, The Watt Stopper, Leviton, or approved.

H. Wall Switch Sensors:
1. 300 sq. ft. area coverage, with a field of view of 180 degrees.
2. Completely self-contained sensor system that fits into a standard single gang box. Internal transformer power supply, a latching dry contact relay switching mechanism compatible with electronic ballasts, compact fluorescent, and inductive loads. Triac and other harmonic generating devices are not allowed.
3. Rated to switch loads from 0 to 800 watt incandescent or fluorescent 120 volt and 0 to 1000 watts for 277 volt.
4. Provide adjustable daylight feature that holds lighting "off" when a desired footcandle level is present.
5. Provide integral off override switch with no leakage current to the load or ground.
6. Provide hard 1mm poly IR2 lens, soft lens is not acceptable.
7. Manufacturers: The Watt Stopper PW Series, Leviton ODS Series or approved.
8. Dual Relay: Sensor Switch, Watt Stopper, Leviton, or approved.

2.2 ULTRASONIC OCCUPANCY SENSORS

A. The occupancy sensors capable of detecting presence, in the controlled floor area by detecting Doppler shifts in transmitted ultrasound.

B. Occupancy sensors are precision crystal controlled and shall not interfere with each other when two or more are placed in the same area. Provide ultrasonic circuit with solid state crystal controlled with advanced signal processing.

C. Furnish each sensor with a convenient shunt provision enabling an individual to bypass the sensor in the event of failure. This bypass provision pin or device shall remain in the sensor and be visible from the floor as a constant reminder that the automatic function has been bypassed.

D. Ceiling mounted with maximum protrusion of 1.5” and blend in aesthetically with the ceiling.

E. Provide multi-directional transmitter and ultrasonic receivers that are temperature and humidity resistant.

F. Sensors can be wired in parallel to allow coverage of large areas.

G. Sensitivity adjustment shall range from off at "0" to maximum at "10."

H. Sensors shall operate on 24VDC power.

I. UL listed power pack consisting of a transformer and contact closure relay in one package. Provide a transformer that is capable of operating up to three occupancy sensors.

J. Manufacturers: Sensor Switch, Watt Stopper Ultrasonic Series, Leviton, or approved.

2.3 DUAL TECHNOLOGY SENSORS

A. Utilize same technologies as passive infrared and ultrasonic.

B. Upon a person entering a space, motion from both technologies must be sensed before lighting will be turned on. After this has occurred, detection by either technology will hold lighting on for the set time period. Sensor shall have a retrigger time delay where only one motion is necessary to turn on the lights within 5 seconds after turning off.

C. Sensors shall have an additional single pole, double throw isolated relay with normally open, normally closed, and common outputs rated at 1 amp for 24VDC and 1/2 amp at 120VAC. The isolated relay is for use with HVAC control, data logging, and other control options.

D. Manufacturers: Sensor Switch, Watt Stopper, Leviton, or approved.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install occupancy sensors as directed by manufacturer's instructions. Complete all electrical connections to all control circuits, occupancy sensors, power supply pack and low voltage wiring.

B. Verify with manufacturer's representative that the sensors are laid out in compliance to manufacturer’s published sensing distribution. Provide additional sensors for complete coverage of the space being sensed.

3.2 QUALITY CONTROL

A. Use manufacturer's published testing and adjusting procedures to adjust sensors time delay, daylight sensitivity, and passive infrared sensitivity to satisfaction of the Owner.

END OF SECTION

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SECTION 26 09 43 – NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. The lighting control system specified in this section shall provide time-based, sensor-based (both occupancy and daylight), and manual lighting control.

B. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed)

C. All system devices shall be networked together enabling digital communication and shall be individually addressable.

D. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity even if network connectivity to the greater system is lost.

E. The system architecture shall facilitate remote operation via a computer connection.

F. The system shall not require any centrally hardwired switching equipment.

1.2 SUBMITTALS

A. Product Datasheets (general device descriptions, dimensions, wiring details, nomenclature)

B. Riser Diagrams – typical per room type (detailed drawings showing device interconnectivity of devices)

C. Other Diagrams – as needed for special operation or interaction with other system(s)

D. Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory start-up.

E. Hardware and Software Operation Manuals

F. Other operational descriptions as needed.

1.3 QUALITY ASSURANCE

A. All steps in sensor manufacturing process shall occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.

B. All components and the manufacturing facility where product was manufactured must be ROHS compliant.

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C. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.

D. All applicable products must be UL / CUL Listed or other acceptable national testing organization.

1.4 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

B. Coordinate lighting controls with BAS (if necessary) either through IP based intercommunication of system or hardwired auxiliary relay outputs.

C. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.5 WARRANTY

A. All devices in lighting control system shall have a 5 year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This specification is based on the nLight® Network Control System from Sensor Switch, an Acuity Brands Company (800-727-7483, www.sensorswitch.com).

2.2 SYSTEM REQUIREMENTS

A. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones 3) network backbone for remote or time based operation.

B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.

C. System must interface directly with intelligent LED luminaires such that only CAT-5 cabling is required to interconnect luminaires with control components such as sensors and switches.

D. Intelligent lighting control devices shall communicate digitally, require ~3 mA of current to function (Graphic WallPod excluded), and possess at least two RJ-45 connectors.

E. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.

F. Devices within a lighting control zone shall be connected with CAT-5 low voltage cabling in any order.

G. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.

H. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.

I. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, or from the network backbone. Standalone “bus power supplies” shall not be required in all cases.

J. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in a remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.

K. System shall have one or more primary wall mounted network control “gateway” devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.

L. System shall use “bridge” devices that route communication and distribute power for up to 8 directly connected lighting zones together for purposes of decreasing system wiring requirements.

M. System shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control profiles.

N. Individual lighting zones shall be capable of being segmented into several channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.

O. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week utilization of a space. Note operating modes should be utilized only in manners consistent with local energy codes.
   1. Auto-On / Auto-Off (via occupancy sensors):
      a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
      b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
      c. Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.
   2. Manual-On / Auto-Off (also called Semi-Automatic)

a. Pushing a switch will turn lights on.
b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

3. Manual-On to Auto-On/Auto-Off
   a. Pushing a switch will turn lights on.
   b. After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.
   c. Sequence can be reset via scheduled (ex. daily each morning) events.
4. Auto-to-Override On
   a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
   b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
   c. Sequence can be reset via scheduled (ex. daily each morning) events
5. Manual-to-Override On
   a. Pushing a switch will turn lights on.
   b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
   c. Sequence can be reset via scheduled (ex. daily each morning) events
6. Auto On / Predictive Off
   a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
   b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
   c. If switch is pressed, lights turn off and a short “exit timer” begins. After timer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to auto-on. If occupancy is detected, lights must be turned on via the switch.
7. Multi-Level Operation (multiple lighting levels per manual button press)
   a. Operating mode designed specifically for bi-level applications
   b. Enables the user to cycle through the up to four potential on/off lighting states using only a single button.
   c. Eliminates user confusion as to which of two buttons controls which load
   d. Three different transition sequences are available in order to comply with energy codes or user preference)
   e. Mode available as a setting on all nLight devices that have single manual switch (ex. nWSD, nPODM, nPODM-DX).

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f. Depending on the sequence selected, every button push steps through relays states according to below table:

Sequence	Altern. Seq		Full On Seq.		3 Step On Seq.	
State #	Relay 1	Relay 2	Relay 1	Relay 2	Relay 1	Relay 2
1	On	Off	On	Off	On	Off
2	Off	On	-	-	Off	On
3	-	-	On	On	On	On
4*	Off	Off	Off	Off	Off	Off

(*step only present for devices without separate off button)

P. Task bar style desktop application shall be available for personal lighting control.

Q. An application that runs on “smart” handheld devices (such as an Apple® IPhone®) shall be available for personal lighting control.

R. Control software shall enable logging of system performance data and presenting useful information in a web-based graphical format and downloadable to .CSV files.

S. Control software shall enable integration with a BMS via BACnet IP.

T. System shall provide the option of having pre-terminated plenum rated CAT-5 cabling supplied with hardware.

2.3 INDIVIDUAL DEVICE SPECIFICATIONS

A. Control Module (Gateway)
1. Module shall be a wall mounted user accessible device that is capable of communicating and controlling downstream system control devices and linking into an Ethernet.
2. Devices shall be powered by low voltage, fit within a two gang switch box (or mounting ring), and have a backlit LCD panel.
3. User control shall be made available via finger-touch buttons with no moving parts. Buttons shall be capable of being locked for security.
4. Device shall have three RJ-45 ports for connection to other backbone devices (bridges) or directly to a lighting control zones devices.
5. Device shall automatically detect all devices downstream of it.
6. Device shall have a standard and astronomical internal time clock.
7. Device shall have one RJ-45 10/100 BaseT Ethernet connection.
8. Each control gateway device shall be capable of linking 400 devices to the management software.
9. Device shall be capable of using a dedicated or DHCP assigned IP address.
10. Network Control Gateway device shall be the following Sensor Switch model number: nGWY.

B. Networked System Occupancy Sensors
1. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.

2. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
3. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.
4. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.
5. All sensing technologies shall be acoustically passive meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.
6. Sensors shall be available with zero, one, or two integrated Class 1 switching relays, and up to one 0-10 VDC dimming output. Sensors shall be capable of switching 120 / 277 / 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor. Relays shall be dry contacts.
7. Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.
8. Sensors shall be available in multiple lens options which are customized for specific applications.
9. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
10. All sensors shall have two RJ-45 ports.
11. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue
12. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
13. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.
14. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.
15. Wall switch sensors shall recess into single-gang switch box and fit a standard GFI opening.
16. Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.
17. Wall switch sensors shall have optional features for photocell/daylight override, vandal resistant lens, and low temperature/high humidity operation.
18. Wall switch sensors shall be available in four standard colors match wiring device color.
19. Wall switch sensors shall be the following Sensor Switch model numbers, with device color and optional features as specified:
    a. nWSD (PIR, 1 Relay)
    b. nWSD PDT (Dual Technology, 1 Relay)
    c. nWSD 2P (PIR, 2 Relays)

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d. nWSD PDT 2P (Dual Technology, 2 Relays)
e. nWSD NL (PIR w/ Night Light, 1 Relay)
f. nWSD PDT NL (Dual Technology w/ Night Light, 1 Relay)
g. nWSD LV (PIR, No Relay)
h. nWSD PDT LV (Dual Technology w/ Night Light, No Relay)

20. Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.
21. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
22. Sensors with dimming can control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of Class 2 current (typically 40 or more ballasts).
23. Sensors shall be the following Sensor Switch model numbers, with device options as specified:

Model # Series	Occup. Poles	# of Relays	Lens Type	Det. Tech.
nCM(B) 9	1	-	Standard	PIR
nCM(B) 9 2P	2	-	Standard	PIR
nCMR(B) 9	1	1	Standard	PIR
nCMR(B) 9 2P	2	2	Standard	PIR
nCM(B) PDT 9	1	-	Standard	Dual
nCM(B) PDT 9 2P	2	-	Standard	Dual
nCMR(B) PDT 9	1	1	Standard	Dual
nCMR(B) PDT 9 2P	2	2	Standard	Dual
nCM(B) 10	1	-	Extended	PIR
nCM(B) 10 2P	2	-	Extended	PIR
nCMR(B) 10	1	1	Extended	PIR
nCMR(B) 10 2P	2	2	Extended	PIR
nCM(B) PDT 10	1	-	Extended	Dual
nCM(B) PDT 10 2P	2	-	Extended	Dual
nCMR(B) PDT 10	1	1	Extended	Dual
nCMR(B) PDT 10 2P	2	2	Extended	Dual
nWV 16	1	-	Wide View	PIR
nWV PDT 16	1	-	Wide View	Dual
nHW13	1	-	Hallway	PIR
nCM(B) 6	1	-	High Bay	PIR
nCMR(B) 6	1	1	High Bay	PIR
nCMR(B) 6 2P	2	2	High Bay	PIR
nCMR(B) 6 480	1	2	High Bay	PIR

Note: Recessed mount versions of the above ceiling (fixture) mount versions also shall be available (e.g. nCMR(B) 9 => nRMR 9)

C. Networked System Daylight (Photocell and or Dimming) Sensors
1. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
2. Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.

3. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
4. Dimming sensors shall control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more ballasts).
5. Photocell and dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the “auto set-point” setting.)
6. Combination units that have all features of on/off photocell and dimming sensors shall also be available.
7. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an “offset” from the primary zone.
8. Line voltage versions of the above described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC, 277 VAC, and 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load. Relays shall be dry contacts.
9. Sensor shall be the following Sensor Switch model numbers, with device options as specified:
    a. nCM(B) PC (on/off)
    b. nCM(B) ADC (dimming)
    c. nCM(B) PC ADC (on/off, 0-10 VDC dimming)
    d. nCMR(B) PC (on/off, single relay)
    e. nCMR(B) PC ADC (on/off, 0-10 VDC dimming, single relay)

    Note: Recessed mount versions of the above ceiling (fixture) mount versions also shall be available (e.g. nCMR(B) PC => nRMR PC)

D. Networked System Power (Relay) Packs
1. Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2nd relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
2. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.
3. All devices shall have two RJ-45 ports.
4. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
5. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
6. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.

7. Power (Secondary) Packs shall be available that provide up to 16 Amp switching of all load types, and be rated for 400,000 cycles.
8. Specific Secondary Packs shall be available that provide up to 5 Amps of switching as well as 0-10 VDC dimming of fluorescent ballasts.
9. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
10. Specific Secondary Packs shall be available that provide up to 5 Amps of switching of dual phase (208/240/480 VAC) lighting loads.
11. Specific Secondary Packs shall be available that require a manual switch signal (via a networked Wall Station) in order to close its relay.
12. Specific Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits.
13. Power (Relay) Packs and Supplies shall be the following Sensor Switch model numbers:
    a. nPP16 (Power Pack w/ 16A relay)
    b. nSP16 (Secondary Pack w/ 16A relay)
    c. nSP16 SA (Secondary Pack w/ 16A relay, Manual On)
    d. nSP5 2P (Secondary Pack w/ two 5A relays)
    e. nSP5 D (Secondary Pack w/ 5A relay and 0-10VDC dimming output)
    f. nSP5 D ER (UL924 Listed Secondary Pack w/ 5A relay and 0-10VDC dimming output for switching emergency power circuits)
    g. nSP5 PCD 2W (Secondary Pack w/ 5A relay and incandescent dimming or 2-wire line voltage fluorescent dimming output)
    h. nSP5 PCD 3W (Secondary Pack w/ 5A relay and 3-wire line voltage fluorescent dimming output)
    i. nSP5 480 (Secondary Pack w/ 5A relay for switching 208/240/480 VAC loads
    j. nPS 80 (Power Supply)
    k. nAR 40 (Low voltage auxiliary relay pack)

E. Networked System Relay & Dimming Panels
1. Panel shall incorporate up to 4 normally closed latching relays capable of switching 120/277 VAC or up to 2 Dual Phase relays capable of switching 208/240/480 VAC loads.
2. Relays shall be rated to switch up to a 30A ballast load at 277 VAC.
3. Panel shall provide one 0-10VDC dimming output paired with each relay.
4. Panel shall power itself from an integrated 120/277 VAC supply.
5. Panel shall be capable of operating as either two networked devices or as one.
6. Panel shall supply current limited low voltage power to other networked devices connected via CAT-5.
7. Panel shall provide auxiliary low voltage device power connected wired directly to a dedicated terminal connection
8. Power (Relay) Packs and Supplies shall be the following Sensor Switch model numbers:
    a. nPANEL 4 (Panel w/ four 120/277 VAC relays and four 0-10 VDC dimming outputs)
    b. nPANEL 2 480 (Panel w/ two dual phase relays (208/240/480 VAC) and two 0-10 VDC dimming outputs).

F. Networked Auxiliary Input / Output Devices
1. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.
2. Devices shall have two RJ-45 ports

3. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
4. Devices shall have a dimming control output that can control 0 to 10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current (typically 40 or more ballasts).
5. Devices shall have an input that read a 0 to 10 VDC signal from an external device.
6. Device shall have a switch input that can interface with either a maintained or momentary switch and run a switch event, or run a local/remote control profile
7. A specific I/O device shall sense state of low voltage outdoor photocells
8. Auxiliary Input/Output Devices shall be the following Sensor Switch model numbers:
    a. nIO (I/O device with dimming or contact closure input and 0-10VDC dimmng output)
    b. nIO KO (1/2 knockout mountable, I/O device with dimming or contact closure input and 0-10VDC dimmng output)
    c. nIO NLI (Input device for detecting state of low voltage outdoor photocell; sold in nIO PC KIT only)

G. Networked LED Luminaires
1. LED luminaire shall have a mechanically integrated control device.
2. LED luminaire shall have two RJ-45 ports
3. LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers)
4. LED luminaire shall provide low voltage power to other networked control devices
5. System shall be able to turn on/off LED luminaire without using a relay
6. System shall be able to maintain constant lumen output over the specified life of the LED luminarie (also called lumen compensation) by varying the input control power (and thus saving up to 20% power usage).
7. System shall indicate (via a blink warning) when the LED luminaire has reached its expected life (in hrs).
8. LED Luminaires shall be the following Lithonia model families:
    a. RTLED
    b. TLED
    c. VLED
    d. ACLED

H. Networked System Wall Switches & Dimmers
1. Devices shall recess into single-gang switch box and fit a standard GFI opening.
2. Devices shall be available with zero or one integrated Class 1 switching relay.
3. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
4. All sensors shall have two RJ-45 ports.
5. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
6. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
7. Devices with dimming control outputs can control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of current (typically 40 or more ballasts).
8. Devices with capacitive touch buttons shall provide audible user feedback with different sounds for on/off, raise/lower, start-up, and communication offline.
9. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
10. Devices with mechanical push-buttons shall be made available with custom button labeling

11. Devices with a single on button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.
12. Wall switches & dimmers shall be the following Sensor Switch model numbers, with device options as specified:
    a. nPOD (single on/off, capacitive touch, audible user feedback)
    b. nPOD 2P (dual on/off, capacitive touch, audible user feedback)
    c. nPODR (single on/off, one relay, capacitive touch, audible user feedback)
    d. nPODM (single on/off, push-buttons, LED user feedback)
    e. nPODM 2P (dual on/off, push-buttons, LED user feedback)
    f. nPODM DX (single on/off, single dimming raise/lower, push-buttons, LED user feedback)
    g. nPODM 2P DX (dual on/off, dual dimming raise/lower, push-buttons, LED user feedback)
    h. nPODM 4P (quad on/off, push-buttons, LED user feedback)
    i. nPODM 4P DX (quad on/off, quad dimming raise-lower, push-buttons, LED user feedback)

I. Networked System Graphic Wall Station
1. Device shall have a 3.5” full color touch screen for selecting up to 8 programmable lighting control presets or acting as up to 16 on/off/dim control switches.
2. Device shall enable configuration of lighting presets, switched, and dimmers via password protected setup screens.
3. Device shall enable user supplied .jpg screen saver image to be uploaded.
4. Device shall surface mount to single-gang switch box
5. Device shall have a micro-USB style connector for local computer connectivity.
6. Device shall have two RJ-45 ports for communication
7. Device shall be the following Sensor Switch model number:
    a. nPOD GFX

J. Networked System Scene Controllers
1. Device shall have two to four buttons for selecting programmable lighting control profiles or acting as on/off switches.
2. Device shall recess into single-gang switch box and fit a standard GFI opening.
3. Devices shall provide LED user feedback.
4. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
5. All sensors shall have two RJ-45 ports.
6. Device shall have four touch sensitive buttons for selecting programmable lighting control scenes/profiles.
7. Device shall be capable of reprogramming other devices in its zone so as to implement user selected lighting scene.
8. Device shall be capable of selecting a lighting profile be run by the system’s upstream Gateway so as to implement selected lighting profile across multiple zones (and not just its local zone).
9. Device shall have LEDs indicating current selection.
10. Scene Selector device shall be the following Sensor Switch model number:
    a. nPODS (4 Scene, capacitive touch)
    b. nPODM 2S (2 Scene, push-button)
    c. nPODM 4S (4 Scene, push-button)

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K. Communication Bridges
   1. Device shall surface mount to a standard 4” x 4” square junction box.
   2. Device shall have 8 RJ-45 ports.
   3. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.
   4. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.
   5. Device shall be careful of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.
   6. Communication Bridge devices shall be the following Sensor Switch model numbers:
      a. nBRG 8 (8 Ports)

2.4 LIGHTING CONTROL PROFILES

A. Changes to the operation of the system shall be capable of being made in real-time or scheduled via lighting control profiles. These profiles are outlines of settings that direct how a collection of devices function for a defined time period.

B. Lighting control profiles shall be capable of being created and applied to a single device, zone of devices, or customized group of zones.

C. All relays and dimming outputs shall be capable of being scheduled to track or ignore information regarding occupancy, daylight, and local user switches via lighting control profiles.

D. Every device parameter (e.g. sensor time delay and photocell set-point) shall be configurable via a lighting control profile.

E. All lighting control profiles shall be stored on the network control gateway device and on the software’s host server.

F. Lighting control profiles shall be capable of being scheduled to run according to the following calendar options: start date/hour/minute, end date/hour/minute, and sunrise/sunset +/- timed offsets.

G. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.

H. Daylight savings time adjustments shall be capable of being performed automatically, if desired.

I. Lighting control profile schedules shall be capable of being given the following recurrence settings: daily, weekday, weekend, weekly, monthly, and yearly.

J. Software shall provide a graphical tool for easily viewing scheduled lighting control profiles.

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2.5 MANAGEMENT SOFTWARE

A. Every device parameter (e.g. sensor time delay and photocell set-point) shall be available and configurable remotely from the software

B. The following status monitoring information shall be made available from the software for all devices for which it is applicable: current occupancy status, current PIR Status, current Microphonics Status, remaining occupancy time delay(s), current photocell reading, current photocell inhibiting state, photocell transitions time remaining, current dim level, device temperature, and device relay state(s).

C. The following device identification information shall be made available from the software: model number, model description, serial number, manufacturing date code, custom label(s), and parent network device.

D. A printable network inventory report shall be available via the software.

E. A printable report detailing all system profiles shall be available via the software.

F. Software shall require all users to login with a User Name and Password.

G. Software shall provide at least three permission levels for users.

H. All sensitive stored information and privileged communication by the software shall be encrypted.

I. All device firmware and system software updates must be available for automatic download and installation via the internet.

J. Software shall be capable of managing systems interconnected via a WAN (wide area network).

2.6 BMS COMPATIBILITY

A. System shall provide a BACnet IP gateway as a downloadable software plug-in to its management software. No additional hardware shall be required.

B. BACnet IP gateway software shall communicate information gathered by networked system to other building management systems.

C. BACnet IP gateway software shall translate and forward lighting relay and other select control commands from BMS system to networked control devices.

2.7 SYSTEM ENERGY ANALYSIS & REPORTING SOFTWARE

A. System shall be capable of reporting lighting system events and performance data back to the management software for display and analysis.

B. Intuitive graphical screens shall be displayed in order to facilitate simple viewing of system energy performance.

C. An “Energy Scorecard” shall be display that shows calculated energy savings in dollars, KWHr, or CO2.

D. Software shall calculate the allocation of energy savings to different control measures (occupancy sensors, photocells, manual switching, etc).

E. Energy savings data shall be calculated for the system as a whole or for individual zones.

F. A time scaled graph showing all relay transitions shall be presented.

G. A time scaled graph showing a zones occupancy time delay shall be presented

H. A time scaled graph showing the total light level shall be presented.

I. User shall be able to customize the baseline run-time hours for a space.

J. User shall be able to customize up to four time-of-day billing rates and schedules.

K. Data shall be made available via a .CSV file

2.8 START-UP & SUPPORT FEATURES

A. To facilitate start-up, all devices daisy-chained together (using CAT-5) shall automatically be grouped together into a functional lighting control zone.

B. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.

C. Once software is installed, system shall be able to auto-discover all system devices without requiring any commissioning.

D. All system devices shall be capable of being given user defined names.

E. All devices within the network shall be able to have their firmware reprogrammed remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.

F. All sensor devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.

END OF SECTION

SECTION 26 12 00 – MEDIUM VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Padmounted transformers.
   2. Padmounted transformers shall be complete, continuous duty, integral assembly, grounded, tamper-resistant, weatherproof, outdoor type with liquid-immersed transformers.

B. Related Work:
   1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 05 13, MEDIUM VOLTAGE CABLES (Above 600 Volts): Medium voltage cables.
   3. Section 26 24 16, PANELBOARDS: Low voltage panelboards.
   4. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground currents.

1.3 SUBMITTALS

A. In accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL, submit the following:

B. Shop Drawings:
   1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
   2. Include electrical ratings, nameplate data, impedance, dimensions, weight, mounting details, decibel rating, termination information, temperature rise, no load and full load losses, regulation, overcurrent protection, connection diagrams, and accessories.

C. Manuals:
   1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.
      a. Identify terminals on wiring diagrams to facilitate installation, maintenance and operation.
      b. Indicate, on wiring diagrams, the internal wiring for each item of equipment and interconnections between the items of equipment.

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c. Approvals will be based on complete submissions of manuals together with shop drawings.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Concrete Institute (ACI):
1. 318-02 Building Code Requirements for Structural Concrete.

C. American National Standards Institute (ANSI):
1. C37.47-00 High Voltage Current-Limiting Type Distribution Class Fuses And Fuse Disconnecting Switches.
2. C57.12.25-90 Transformers-Pad-Mounted, Compartmental-Type, Self Cooled, Single-Phase Distribution Transformers with Separable Insulated High Voltage Connectors; High Voltage, 34500 Grd Y/19920 Volts and Below; Low-Voltage 240/120 Volts; 167 kVA and Smaller-Requirements.
3. C57.12.28-96 Pad-Mounted Equipment Enclosure Integrity.
4. C57.12.29-99 Switchgear and Transformers – Pad-Mounted Equipment – Enclosure Integrity for Coastal Environments.

D. American Society for Testing and Materials (ASTM):
1. D3487-00Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus.

E. Institute of Electrical and Electronic Engineers (IEEE):
1. 48-96 Standard Test Procedures and Requirements for Alternating Current Cable Terminations 2.5kV Through 765kV.
2. 386-95 Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V (ANSI/IEEE).
3. 592-90 Standard for Exposed Semiconducting Shields on Premolded High Voltage Cable Joints and Separable Insulated Connectors.

F. National Electrical Manufacturers Association (NEMA):
1. C57.12.26-93 Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34500 Grd Y/19920 Volts and Below; 2500 kVA and Smaller TR1-93 Transformers, Regulators, and Reactors.

G. National Fire Protection Association (NFPA):
1. 70-02 California Electrical Code (CEC).

H. Underwriters Laboratories Inc. (UL):
1. 467-93 UL Standard for Safety Grounding and Bonding Equipment.

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PART 2 - PRODUCTS

2.1 EQUIPMENT, GENERAL

A. Equipment shall be in accordance with ANSI, ASTM, IEEE, NEMA, NFPA, UL, as shown on the drawings and as hereinafter specified.

B. Ratings shall not be less than shown on the drawings.

C. Provide units designed to withstand the mechanical stresses caused by rough handling during shipment in addition to the electrical and mechanical stresses that may occur during operation.

D. Completely fabricate units at the factory so that only the external cable connections are required at the job site.

E. Thoroughly clean, phosphatize and finish all the metal surfaces at the factory with a rust-resistant primer and dark green enamel finish coat, except where a different color is specified in Paint Section, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULE. All surfaces of the unit that will be in contact with the concrete pad shall be treated with corrosion-resistant compounds and epoxy resin, or a rubberized sealing compound.

2.2 COMPARTMENTS

A. Construction:
   1. The high and low voltage compartments and the transformer compartment shall be fabricated by a single manufacturer. The compartments and the transformer tank shall be assembled as an integral unit by a single manufacturer. Enclosures shall be in accordance with ANSI C57.12.28 or ANSI C57.12.29 if installed in coastal environments.
   2. The high and low voltage compartments shall be separated with a steel barrier.
   3. The compartments shall be constructed of sheet steel (gage to meet ANSI requirements) with bracing, reinforcing gussets and jig-welding to assure rectangular rigidity.
   4. Use cadmium or zinc plated bolts, nuts and washers.
   5. Sufficient space shall be provided for equipment, cabling and terminations in the compartments.
   6. Affix the transformer instruction nameplate permanently to the unit within the low voltage compartment. Voltage ratings, kVA rating, connection configuration, impedance, date of manufacture and serial number shall be shown on the nameplate.

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B. Doors:
   1. Provide a separate door for each compartment with provision for a single padlock to secure the compartment area. The high voltage compartment door shall be prevented mechanically from opening, unless the low voltage door is opened and penta head bolt is removed.
   2. The secondary compartment door shall have a one-piece steel handle and incorporate three-point locking mechanisms to assure a secure and tight door closing. Provide each compartment door with open-position doorstops and tamperproof hinges. The hinge assembly shall be made of corrosion-resistant material welded in place.

2.3 BIL RATING

A. 15 kV class equipment shall have a minimum 125 kV BIL rating.

2.4 DEAD FRONT CONSTRUCTION

A. No exposed live parts, including the cable terminations, shall be accessible within the high voltage compartment.

B. Make connection to the high voltage switch(es) through 200 ampere externally clamped universal bushing wells mounted within the transformer tank and bushing inserts. Provide a parking stand for each cable that terminates within the high voltage compartment.

2.5 HIGH VOLTAGE PREFORMED TERMINATIONS

A. Terminate the high voltage cables in the high voltage compartment with load break premolded rubber elbow connectors. Elbow connectors shall have a minimum of 0.125 inch semi-conductive shield material covering the housing. Each connector shall be tested - prior to shipment from the factory.

B. Ground metallic cable shields with a device designed for the purpose. It shall consist of a solderless connector enclosed in watertight rubber housing covering the entire assembly. The grounding device and elbow connector are to be of the same manufacturer to insure electrical integrity of shielded parts.

C. Premolded parts shall be suitable for submersible applications.

D. Elbow connectors shall be rated as follows:
   1. Voltage: 15 kV phase-to-phase.
   2. BIL: 125 kV.
   3. AC withstand: 34 kV, 60 Hz for 1 minute.
   4. DC withstand: 65 kV (field test rating).
   5. Corona voltage: 11 kV minimum.
   6. Continuous current: 200 amperes RMS.
   7. Short time current: 10,000 amperes for 12 cycles.
   8. Fault closure: 10,000 amperes RMS symmetrical for 10 cycles (after 10 loadmake/loadbreak operations at 200 amperes and 21 kV contact voltage).

E. Interchangeability: The separable connector system shall include the loadbreak elbow, the bushing insert, and bushing well. Separable connectors shall comply with the requirements of IEEE 386, and shall be interchangeable between suppliers. Loadbreak elbow and bushing insert shall be from the same manufacturer.

F. Allow sufficient slack in high voltage cable, ground, and drain wires to permit elbow connectors to be moved to their respective parking stands.

G. Provide insulated cable supports to relieve any strain imposed by cable weight or movement.

2.6 LOW VOLTAGE EQUIPMENT

A. Where applicable, mount the transformer secondary main molded case circuit breaker, panelboard, low voltage bushings, and hot stick in the low voltage compartment. Mount the main breaker off of the transformer tank to allow sufficient ventilation and assure that the heat from the transformer tank will not be transmitted through conduction. Circuit breakers shall be of the ambient compensating type, and have interrupting ratings for the available fault current.

B. Tin plate the low voltage neutral terminal and isolate from the transformer tank. Provide a removable ground strap sized in accordance with the CEC and connect between the neutral and ground pad.

2.7 TRANSFORMERS

A. Transformers shall be three-phase and single-phase, liquid-immersed, isolated winding, and self cooled by natural convection.

B. The kVA ratings shown on the drawings are for continuous duty without the use of cooling fans.

C. Temperature rises shall not exceed the NEMA TR1 standards of 65 degrees C by resistance, and 80 degrees C hot spot at rated kVA.

D. Transformer insulating material shall be vegetable Type FR3 oil and shall be in accordance with ASTM.

E. Transformer impedance shall be not less than 4.5 percent for sizes 150 kVA and larger.

F. Sound levels shall conform to NEMA TR1 standards.

G. Primary and Secondary Windings for Three-phase Transformers:
   1. Primary windings shall be delta connected.
   2. Secondary windings shall be wye connected, except where otherwise indicated on the drawings. Provide isolated neutral bushings for secondary wye connected transformers.
   3. Secondary leads shall be brought out through pressure-tight epoxy bushings.

H. Primary windings shall have four 2-1/2 percent full capacity voltage taps; two taps above and two taps below rated voltage.

I. Core and Coil Assemblies:

1. Cores shall be grain-oriented, non-aging, silicon steel to minimize losses.
2. Core and coil assemblies shall be rigidly braced to withstand the stresses caused by rough handling during shipment, and stresses caused by any possible short circuit currents.
3. Coils shall be continuous winding type without splices except for taps.
4. Coil and core losses shall be optimum for the most efficient operation.
5. Primary, secondary and tap connections shall be brazed or pressure type.
6. Provide end fillers or tie downs for coil windings.

J. The transformer tank, cover, and radiator gage thickness shall not be less than that outlined in ANSI.

K. Accessories:
1. Provide standard NEMA features, accessories, and the following:
   a. No-load tap changer (Provide warning sign).
   b. Lifting, pulling and jacking facilities.
   c. Globe-type valve for oil filtering and draining, including sampling device.
   d. Pressure relief valve.
   e. Liquid level gage and filling plug.
   f. A grounding pad in the high and low voltage compartments.
   g. A diagrammatic nameplate and operating instructions enclosed by a transparent cover located in the low voltage compartment.
   h. Dial type liquid thermometer with a maximum reading pointer and an external reset.
   i. Hot stick. Securely fasten hot stick within low voltage compartment.
2. The accessories shall be made accessible within the compartments without disassembling trims and covers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the equipment in accordance with the CEC, as shown on the drawings, and as recommended by the equipment manufacturer.

B. Foundations:
1. Provide foundations of reinforced concrete, Type C, 3000 psi minimum, 28-day compressive strength, and comply with the ACI 318.
2. Locate the top of foundation pads 6” above the adjacent finished grade, unless otherwise shown on the drawings. Refer to drawings for size, location, and structural steel reinforcing required.
3. Grade the adjacent terrain so that surface water will flow away from the foundation.
4. Anchor the transformers with cadmium or zinc plated bolts, nuts and washers. Bolts shall not be less than 1/2" diameter.

C. Grounding
1. Ground each padmounted transformer in accordance with the requirements of the CEC. Install 3/4" diameter by 10’ long copper-clad ground rods, driven 10’ below grade to maintain a maximum resistance of five ohms to ground. Thermite weld the cable to the ground rods.

2. Connect the ground rod to the ground pads in the high and low voltage compartments, and to the secondary (and primary) neutral with not less than a 2/0 AWG bare copper conductor.
3. Refer to the section of the specifications describing GROUNDING for testing.
4. Independently connect cable shield grounding devices ground wires to ground with sufficient slack to permit elbow connector operation. Connect elbow connectors with a No. 14 AWG bare copper drain wire from its grounding eye to the related cable shield grounding device ground wire. Do not connect drain wires in any manner that will permit circulating currents, or cable fault currents, to pass through them.
5. Pad mounted equipment shall be sealed with caulking between bottom of metal housing and the concrete pad or slab to prevent entrance of dust and debris.

3.2 SPARE PARTS

A. Deliver the following spare parts for the project to the Owner two weeks prior to final inspection:
   1. Six stand-off insulators.
   2. Six insulated protective caps.
   3. One spare set of high voltage fuses for each size fuse used in the project.

3.3 INSTRUCTIONS

A. The contractor shall instruct School District maintenance personnel, for not less than a 2-hour period, on the maintenance and operation of the equipment on the date requested by the IOR.

END OF SECTION

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SECTION 26 22 00 – LOW VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Dry type general purpose transformers rated 600 volts and below.

B. Related Work:
   1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.
   3. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Shop Drawings:
   1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
   2. Include electrical rating, impedance, dimensions, weight, mounting details and materials, decibel rating, terminations, temperature rise, no load and full load losses, and connection diagrams.
   3. Complete nameplate data including manufacturer’s name and catalog number.

C. Manuals:
   1. Submit, simultaneously with the shop drawings, companion copies of complete operating and maintenance manuals including technical data sheets and wiring diagrams.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. National Fire Protection Association (NFPA):

1. 70-2010 California Electrical Code (CEC)

C. National Electrical Manufacturers Association (NEMA):
1. ST 20-1992 Dry-Type Transformers for General Applications
2. TP-1-1996 Energy Efficient Transformers

PART 2 - PRODUCTS

2.1 GENERAL PURPOSE DRY TYPE TRANSFORMERS

A. Unless otherwise specified, dry type transformers shall be in accordance with NEMA, CEC and as shown on the drawings. Transformers shall be UL listed or labeled. All transformers shall comply with NEMA TP-1 energy efficiency standards as adopted by the State of California. Efficiency shall be tested in accordance with NEMA TP2.

B. Dry type transformers shall have the following features:
1. Self-cooled by natural convection, isolating windings, indoor, dry type. Autotransformers shall not be accepted unless otherwise stated.
2. Rating and winding connections shall be as shown on the drawings.
3. Ratings shown on the drawings are for continuous-duty without the use of cooling fans.
4. Insulation systems:
   a. Transformers 30 KVA and larger: UL rated 220 degree C system having an average maximum rise by resistance of 115 degree C in a maximum ambient of 40 degree C.
   b. Transformers below 30 KVA: Same as for 30 KVA and larger or UL rated 185 degree C system having an average maximum rise by resistance of 115 degree C in a maximum ambient of 40 degree C.

5. Core and coil assemblies:
   a. Rigidly braced to withstand the stresses caused by short circuit currents and rough handling during shipment.
   b. Cores shall be grain oriented, non-aging, silicon steel.
   c. Coils shall be continuous windings without splices except for taps.
   d. Coil loss and core loss shall be optimum for efficient operation. NEMA TP-1 type.
   e. Primary and secondary tap connections shall be brazed or pressure type.
   f. Coil windings shall have end fillers or tie downs for maximum strength.
   g. Terminals shall be rated 75 degrees C minimum.

6. Certified sound levels determined in accordance with NEMA, that do not exceed the following:

Transformer Rating	Sound Level Rating
0 - 9 KVA	40 dB
10 - 50 KVA	45 dB
51 - 150 KVA	50 dB
151 - 300 KVA	55 dB
301 - 500 KVA	60 dB

7. Nominal impedance shall be as permitted by NEMA.
8. Single phase transformers rated 15 KVA through 25 KVA shall have two, 5 percent full capacity taps below normal rated primary voltage. All transformers rated 30 KVA and larger shall have two, 2-1/2 percent full capacity taps above, and four, 2-1/2 percent full capacity taps below normal rated primary voltage.
9. Core assemblies shall be grounded to their enclosures by adequate flexible ground straps.
10. Enclosures:
    a. Temperature rise at hottest spot shall conform to NEMA Standards, and shall not bake and peel off the enclosure paint after the transformer has been placed in service.
    b. Ventilation openings shall prevent accidental access to live components.
    c. Thoroughly clean and paint at the factory with manufacturer's prime coat and standard finish.
11. Standard NEMA features and accessories including ground pad, lifting provisions and nameplate with the wiring diagram and sound level indicated on it.
12. Dimensions and configurations shall conform to the spaces designated for their installations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the CEC, and as shown on the drawings.

B. Install the transformers with adequate clearance at a minimum 6 inches or more from wall and adjacent equipment for air circulation to remove the heat produced by transformers and as recommended by the manufacturer to achieve U.L. listing.

C. Install transformers on vibration pads designed to suppress transformer noise and vibrations.

D. Use liquidtight flexible metal conduit to contain the conductors from the transformer to the raceway system.

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E. Transformers shall be secured to meet CBC seismic zone 4 requirements.

END OF SECTION

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SECTION 26 24 14 - DISTRIBUTION SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Service and distribution switchboard where shown on the contract drawings and specified herein.

B. Related Work:
   1. Division 09 “PAINTING”: Identification and painting of panelboards.
   2. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   3. Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.
   4. Section 26 05 73 OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY: Requirements for the over current protective devices to be installed to ensure proper equipment and personnel protection.
   5. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
   6. Section 26 0519, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
   7. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 QUALITY ASSURANCE

A. Conform to applicable Codes and NEMA, ANSI and IEEE Standards.

1.4 SUBMITTALS

A. Conform to applicable provisions of Section 01 33 00 of Division 01, SUBMITTALS and of Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Shop Drawings shall show and contain the following information:
   1. Plans showing top and bottom of switchboards.
   2. Front, rear and side elevations of switchboards.
   3. Schematic Wiring Diagrams showing the following:
      a. One-line diagram with each circuit numbered.
      b. Schedule showing circuit number, description, and rating of protective device(s).
      c. Complete short circuit with standability of bus.

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4. 1/4" - 1'-0" scale drawings of electrical rooms or areas overall dimensions for equipment layout including space available for conduits and protective devices.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Each switchboard shall be U.L. listed deadfront, deadrear, completely self-supporting, with the required number of vertical sections bolted together to form one floorstanding switchboard. Construction shall be NEMA Class II with line and load and main bus connections accessible from the front. Provide switchboards of 1000 amperes or greater rating with line and load insulated bus bars. Overcurrent protective devices shall be grouped in convertible type construction. Vertical sections shall have full height bussing and where space for future devices is indicated on the Drawings all the necessary mounting hardware shall be furnished. Switchboards shall include all protective devices and other equipment indicated on the Contract Drawings with the necessary interconnections, instrumentation, and control wiring. Bus shall be copper with plated joints, or tin plated aluminum. Bus bars shall be mounted on supports of high impact-resistant, non-tracking insulating material, and braced to withstand the maximum available fault current as indicated on the Contract Drawings. Other ratings shall be as indicated on the Contract Drawings. Series-connected or "integrated equipment" short circuit ratings shall not be applied in lieu of, or to comply with, short circuit and interrupting capacity ratings indicated on the Drawings, unless specifically approved by the Engineer.

B. Service and distribution sections shall contain circuit breakers, fusible switches, and combination motor starters, with shunt trips, motor operators, ground fault protection, and other accessories, as indicated on the Drawings, as well as provisions for utility metering in accordance with the serving electric utility requirements and/or customer metering. Each disconnecting means shall be provided with a means for individual padlocking. Switches shall be heavy-duty, quick-make and quick-break, and horsepower rated through 500 HP. Switches rated over 600 amperes shall be bolted pressure contact type. Ratings of disconnecting means and overcurrent protective devices shall be as indicated on the Drawings.

C. Finish: Interior finish shall be a gray lacquer or enamel; exterior finish shall be a gray baked-on enamel or lacquer. Apply all finish coatings over a rust-inhibiting metal primer.

D. Identification: Each switchboard shall have an engraved laminated plastic nameplate identifying the switchboard as designated and located on the Contract Drawings, and indicating voltage, phase, and number of system conductors. For example, "Switchboard MS 277/480V. 3Ø 4W. Lettering shall be white on black finish and 2” high minimum. Nameplates shall be affixed by a minimum of two escutcheon pins or screws. Each device on the switchboard shall be provided with an engraved plastic nameplate as specified in Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.

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PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Switchboard(s) shall be securely bolted to the flooring or structure. Final attachment means shall be in compliance with the seismic requirements of governing authority. Shop Drawings indicating the bolt down requirements shall be provided by the manufacturer along with all necessary calculations and shall be submitted with the Shop Drawings of the switchboard equipment. Refer to other Sections of the Specifications related to seismic requirements.

B. Switchboard(s) shall be installed on a level floor, with shims provided where necessary to attain both horizontal and vertical "plumb" conditions.

C. Switchboard(s) equipment shall be protected during construction in such a manner to prevent plaster, paint, dust, etc. from defacing the finish of equipment. Prior to final acceptance of the equipment, the interior of the equipment shall be cleaned of all foreign materials and debris. Any blemishes or defects on the exterior of the equipment shall be repaired by painting the equipment with paint supplied by the manufacturer of the equipment to match the factory finishes.

D. All floor mounted switchgear and panelboards shall be sealed with caulking between bottom of metal housing and the concrete pad or slab to prevent entrance of dust and debris.

E. All openings in switchgear and panelboards that are unused shall be sealed with bolts and washers. Use caulking where holes or openings cannot be sealed by way of a washer, or bolts or conduit seals.

F. All ventilated openings in panelboards and switchboards shall be furnished with dust filters to prevent entrance of dust and debris.

G. No operating handles in any switchboard shall be located above 6’- 6” above finish floor. Code clearances on all sides of the switchboard equipment shall be maintained.

H. Switchboards shall be mechanically grounded to the grounding system.

I. Furnish ammeters, voltmeters, current and potential transformers, test blocks, control switches, fuses and circuit breakers, and other devices as indicated on the Drawings.

J. For solidly grounded "wye" services of more than 150 volts to ground, but not exceeding 600 volts phase to phase, provide ground fault protection of equipment for each service disconnecting means for services rated 1000 amperes or more, without a single main disconnecting means. Provide ground fault protection of equipment for other systems as indicated on the Drawings.

K. Ground fault sensors shall be zero sequence type unless indicated otherwise on the Drawings. Trip settings shall be as indicated on the Drawings or as directed by the Engineer.

L. Protection: Keep switchboards covered during construction operations. Clean interior and exterior after all connections are completed. Factory connections shall be checked and re-

torqued tight as required. Damage shall be field or factory repaired to a condition acceptable to the Engineer at no added cost to the City.

M. Operational Test of the ground fault protection system using the primary current injection method shall be performed by qualified personnel with suitable testing/recording equipment in the presence of the Engineer. Provide the Engineer with a "Certified Test Report" including test parameters.

3.2 ACCEPTANCE TESTING OF SWITCHGEAR AND SWITCHBOARD ASSEMBLIES

A. General:
1. Inspect for physical damage.
2. Compare equipment nameplate information with latest single line diagram and report discrepancies.
3. Inspect for proper alignment, anchorage, and grounding.
4. Check tightness of accessible bolted bus joints by calibrated torque wrench method. Refer to manufacturer's instruction for proper foot pound levels.
5. Key interlock systems shall be physically tested to insure proper function.
   a. Closure attempt shall be made on locked open devices. Opening attempt shall be made on locked closed devices.
   b. Key exchange shall be made with devices operated in off-normal positions.
6. All doors, panels and sections shall be inspected for paint, dents, scratches.
7. Furnish the services and provide report from an independent testing agency for the testing of all GFP circuit breakers.

END OF SECTION

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SECTION 26 24 16 – PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Panelboards.

B. Related Work:
   1. Division 09 “PAINTING”: Identification and painting of panelboards.
   2. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   3. Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.
   4. Section 26 05 73 OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY: Requirements for the over current protective devices to be installed to ensure proper equipment and personnel protection.
   5. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
   6. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
   7. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. Underwriters Laboratories, Inc. (UL):
   1. No. 50 Enclosures for Electrical Equipment
   2. No. 67 Panelboards
   3. No. 489 Molded Case Circuit Breakers and Circuit Breaker enclosures

C. National Fire Protection Association (NFPA):
   1. No. 70-2016 California Electrical Code (CEC)

D. National Electrical Manufacturers Association (NEMA):
   1. No. PB-1 Panelboards.
   2. No. AB-3 Molded Case Circuit Breakers and Their Application.

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PART 2 - PRODUCTS

2.1 PANELBOARDS

A. Panelboards shall be in accordance with UL, NEMA, NEC, CEC and as shown on the drawings. Approved manufacturers are Eaton, Square D, Siemens, ABB/General Electric.

B. Panelboards shall be standard manufactured products. All components of the panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards to be of the same manufacturer.

C. All panelboards shall be dead front safety type. Arrange sections for easy removal without disturbing other sections.

D. All panelboards shall be completely factory assembled with molded case circuit breakers. All factory wiring shall be checked for correct tightness and visually inspected to ensure that bussing and terminations have not become loose in transit to job site.

E. Panelboards shall have main breaker or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting as scheduled on the drawings. Refer to single line diagram and panel schedules on drawings. Terminals shall be minimum 75 degree rated. Back fed main circuit breakers are not allowed. Main circuit breakers shall be vertically mounted.

F. Panelboards shall have the following features:
   1. Nonreduced size copper bus bars, and connection straps bolted together and rigidly supported on molded insulators. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of branch circuit devices.
   2. Full size neutral bar, mounted on insulated supports.
   3. Ground bar and isolation ground bar (where called for in panel schedule) with sufficient terminals for all grounding wires. Buses braced for the available short circuit current.
   4. All breakers and phase bus connections shall be arranged so that it will be possible to substitute a 2-pole breaker for two single pole breakers, and a 3-pole breaker for three single pole breakers, when trip is 30 amps or less and frame size is 100 amperes or less, without having to drill and tap the main bus bars at bus straps. Where used for heating and air conditioning, and refrigeration equipment, use only HACR type U.L. listed circuit breakers.
   5. Design interior so that protective devices can be replaced without removing adjacent units, main bus connectors, and without drilling or tapping.
   6. Where designated on panel schedule as "space", include all necessary bussing, device support and connections. Provide blank cover for each space.
   7. In two section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side with cable connections to the second section. Panelboard sections with tapped bus or crossover bus are not acceptable.
   8. Series rated panelboards are not permitted.
   9. Label all panels in accordance with Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.
   10. Recessed panel space conduit: Provide (1) ¾ inch spare conduit stubbed to accessible ceiling space and/or interstitial space below floor for every (5) spaces and spares indicated on panel schedules.

G. Panelboards serving as building mains shall be “service entrance rated” and UL Listed as “service equipment”.

2.2 CABINETS AND TRIMS

A. Cabinets:
1. Provide galvanized steel cabinets to house panelboards. Cabinets for outdoor panels shall be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL standard for outdoor applications.
2. All ventilated openings in panelboards and switchboards, shall be furnished with dust filters to prevent entrance of dust and debris.
3. Cabinets for panelboards may be of one piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.
4. Provide necessary hardware for "in" and "out" adjustment of panel interior.
5. Cabinets for two section panelboards shall be arranged side by side, and shall be the same height. Flush mounted cabinets should be 1 1/2" apart and coupled by conduit nipple if necessary.
6. Gutter size in panel boxes, on all sides, shall be in accordance with the CEC. Penetrations through gutter to live area of the panelboard shall incorporate approved non-metallic-grommet type of insulation to protect wire passing through.

B. Trims:
1. Fabricate trim of sheet steel consisting of frame with door attached by concealed hinges. Provide flush or surface trim as shown on the drawings.
2. Flush trims shall overlap the box by at least 3/4" all around.
3. Surface trim shall have the same width and height as the box.
4. Flush or surface trims shall not have ventilating openings.
5. Secure trims to back boxes by indicating trim clamps.
6. Provide a welded angle on rear of trim to support and align trim to cabinet.
7. Provide separate trims for each section of multiple section panelboards. Trims and doors of sections shall be of the same height.

C. Doors:
1. Provide doors with flush type latch and manufacturer's standard lock. Doors over 48 inches in height shall have a vault handle and a three-point catch, arranged to fasten door at top, bottom, and center.
2. In making switching devices accessible, doors shall not uncover any live parts.
3. Provide panelboards with door-in-door construction.
4. Provide concealed hinges welded to the doors and trims.
5. For lighting or power contactors incorporated in panelboards, provide separate doors for the contactors.
6. Provide keyed alike system for all panelboards.
7. Provide a directory card, metal holder, and transparent cover. Permanently mount holders on inside of doors.

D. Painting:
1. Thoroughly clean and paint trims and doors at the factory with primer and manufacturer's standard finish.

2.3 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS

A. Breakers shall be UL listed and labeled, in accordance with the CEC, as shown on the drawings, and as specified.

B. Circuit breakers in panelboards shall be bolt on type on phase bus bar or branch circuit bar.
   1. Molded case circuit breakers for lighting and appliance branch circuit panelboards shall have minimum interrupting rating as indicated.
   2. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100 ampere frame or less. Magnetic trip shall be adjustable from 3 times to 10 times for breakers with 600 ampere frames and higher. Factory setting shall be HI, unless otherwise noted.

C. Breaker features shall be as follows:
   1. Integral housing of molded insulating material.
   2. Silver alloy contacts.
   3. Arc quenchers and phase barriers for each pole.
   4. Quick-make, quick-break, operating mechanisms.
   5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
   6. Electrically and mechanically trip free.
   7. An operating handle which indicates ON, TRIPPED, and OFF positions.
      a. Line connections shall be bolted.
      b. Interrupting rating shall not be less than the maximum short circuit current available at the line terminals as indicated on the drawings, and as shown on the electrical system protective device study as required. The interrupting rating shall not be less than the minimum identified requirement.
   8. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.

2.4 SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS

A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with the applicable requirements of those specified for panelboards.

B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with CEC, as shown on the drawings, and as specified.

B. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes and layout of cabinets within the designated spaces. All equipment must

be dimensioned in order to physically fit in the spaces provided and to comply with all code required clearances.

C. Install a typewritten schedule of circuits in each panelboard. Include the room numbers (as finally described by the Owner) and items served on the cards. Obtain final room numbers from Architect prior to creating schedule.

D. Mount the panelboard so that maximum height of the top circuit breaker above finished floor shall not exceed 78 inches.

E. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims, doors, and boxes with finishes to match surrounding surfaces after the panelboards have been installed.

F. Circuit numbers shall correspond to the approved panel schedule. Provide as-built drawings showing the actual circuit numbers being used for each device on each branch circuit if changes are required.

G. Verify depth of all flush mounted enclosures in walls to be certain wall depth will accommodate panel depth prior to installation.

H. All openings in switchgear and panelboards that are unused shall be sealed with bolts and washers. Use caulking where holes or openings cannot be sealed by way of a washer, or bolts or conduit seals.

I. Contractor shall include the services of an independent testing company to test GFI circuit breakers in distribution and main panelboards.

END OF SECTION

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SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Wiring devices.

B. Related Work:
   1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
   3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
   4. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. General: All receptacles shall be listed by Underwriters Laboratories, Inc.
   1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature (this feature does not substitute for a grounding conductor terminated on grounding strap of device). Terminal screws shall be brass, brass plated or a copper alloy metal.
   2. Receptacles shall be of a screw terminal type, “pressure type quick wire” terminations are not allowed.

B. Duplex receptacles shall be premium specification grade single phase, 20 ampere, 120 volts, 2-pole, 3-wire, and conform to the NEMA 5-20R configuration in NEMA WD 6. The duplex type shall have bussing break-off feature for two-circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal.
   1. Wiring device bodies to be white in color.
   2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The remaining receptacle shall be unswitched.
   3. Controlled receptacles; installed per requirements of 2022 BUILDING ENERGY EFFICIENCY STANDARDS / Efficiency Standards, California Code of Regulations, Title 24, Part 6. SECTION 130.5 (d) – ELECTRICAL POWER DISTRIBUTION SYSTEMS as Circuit Controls for 120-Volt Receptacles and / or Controlled Receptacles. Shall be provided with an approved means of including a permanent and durable marking identifying the controlled receptacles or circuits to differentiate them

from uncontrolled receptacles or circuits. Where shown on associated floor plans, and or required by the Standards; a duplex noted to be controlled shall be 'split-wire', so the top outlet shall be switched and the bottom outlet shall be unswitched. A double duplex (fourplex) noted to be controlled: one of the duplex receptacles shall be controlled and the other duplex receptacle shall be unswitched.

4. Duplex Receptacles on Emergency Circuit: Receptacle bodies shall be red in color. Wall plates shall also be powder coat painted red finish. Cover shall be labeled with panel and circuit number.
5. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit suitable for mounting in a standard outlet box.
    a. Ground fault interrupter shall be commercial grade and consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. It shall be rated for operation on a 60 Hz, 120 volt, 20-ampere branch circuit. Device shall meet CEC requirements. Device shall have a minimum nominal tripping time of 1/30th of a second. Devices shall meet UL 943.

C. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete and match with appropriate cord grip plug. Devices shall meet UL 231.

D. Weatherproof Receptacles: Shall consist of a listed weather resistant duplex receptacle, mounted in box with a gasketed, while in use weatherproof, cast metal cover plate and cap receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. Approved manufacturers: Intermatic WP10 Series, Thomas & Betts/Red Dot 2CK Series, or engineer approved equal.

2.2 SWITCHES AND DIMMERS

A. Toggle switches shall be totally enclosed tumbler type with bodies of phenolic compound. Toggle handles color to match receptacle device color unless otherwise specified.
1. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plasters ears and be of a screw terminal type.
2. Shall be color coded for current rating, listed by Underwriters Laboratories, Inc., and meet the requirements of NEMA WD 1, Heavy-Duty and UL 20.
3. Ratings:
    a. 120 volt circuits: 20 amperes at 120-277 volts AC.
    b. 277 volt circuits: 20 amperes at 277 volts AC.
4. The switches shall be mounted on the strike plate side of doors.
5. Incorporate barriers between switches with multi-gang outlet boxes where required by the CEC.
6. All toggle switches shall be of the same manufacturer.

B. Dimmers: Incandescent lamp loads. Wall-mounted incandescent dimmers shall be specification grade with capability of raising and lowering the lighting from completely off to full intensity. Device color shall match all other wiring devices on project.

C. Coordinate lighting control device requirements with 26 09 43 Network Lighting Controls System.

2.3 WALL PLATES

A. Wall plates for switches and receptacles shall be thermo plastic. Color to match wiring device.

B. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD1.

C. For receptacles or switches ganged together, wall plates shall be a single ganged plate.

D. Wall plates for data, telephone or other communication outlets shall be as specified in the associated specification.

E. Surface mounted boxes, NEMA1, shall be industrial grade raised galvanized steel covers. In shop areas all receptacles shall be dust proof and or waterproof where applicable.

F. Waterproof device covers shall be cast iron, 4-corner screw type, for FS and FD type mounting. Device covers shall be zinc galvanized finish. Weatherproof covers shall be lockable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Switches installed in hazardous areas shall be explosion proof type in accordance with the CEC and as shown on the drawings.

B. Installation shall be in accordance with the CEC, NECA “Standard of Installation”, and as shown as on the drawings.

C. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also be connected to the green equipment grounding conductor.

D. General: Devices shall be of the type specified herein. All devices shall be installed with “pigtailed” leads from the outlet box. No device shall be used in the “feed through” application. Screw terminals shall be used to connect all devices to the circuit and shall be grounded by means of a ground wire where grounding terminals are provided in the device.

E. Installation: Devices and plates shall be installed in a “plumb” condition and must be flush with the finish surface of the wall where boxes are recessed.

F. Mounting heights: All control and convenience devices shall comply with California Code of Regulations Title 24 and ADA with respect to accessibility requirements. Mounting heights indicated on plans shall have precedence.

G. Install switches with the off position down.

H. Clean debris from outlet boxes.

I. Provide extension rings as required to bring outlet boxes flush with finished surface or casework.

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J. Test each receptacle device for proper polarity.

END OF SECTION

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SECTION 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Disconnect and safety switches where shown on the contract drawings and specified herein.

B. Related Work:
   1. Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.

PART 2 - PRODUCTS

2.1 GENERAL

A. Approved Manufacturers: Eaton, ABB/General Electric, ITE-Siemens and Square-D.

B. Disconnect Switches: Provide with devices enabling the switch to be locked in the open or closed positions.

C. Manual Motor Switches: Tumbler type rated 3HP, 240 Volts with or without overload heaters as required to protect equipment served.

D. Externally Operable Safety Switches: To have quick-make, quick-break mechanism, capable of switching 10 times switch rating, with cover interlock to prevent opening with switch in ON position and defeat mechanism for maintenance.

E. Switches: Shall be general duty (GD) for 240 volt and below and heavy duty (HD) for 277/480 volt type unless otherwise indicated. Provide NEMA 1 enclosures for interior locations and NEMA 3R enclosures for exterior or wet locations. Provide with number of poles, ampacity, voltage and HP rating, fusible or nonfusible as indicated. Copper blades shall be visible in off position.

F. Fusible Switches: Equip them with rejection clips for UL Class R fuses. Switches having a dual rating when used with dual element fuses shall have a rating so indicated and shall be confirmed by equipment vendor being connected.

G. 600 Amperes or Less Fuses: UL Class RKI with a minimum interrupting rating of 200,000 Amperes, Bussmann "Low-Peak Type" or equal.

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PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Locations: Install switches, disconnects and safety where indicated on the Contract Drawings or as required by CEC.

B. Fastenings: Securely fasten switches to structural members or unistrut support as directed by the manufacturer.

C. Manual Motor Switches: Install flush mounted in finished areas.

D. Manual Motor Switches: Install surface mounted in equipment rooms and non-finished areas. Where installed above inaccessible ceilings provide access panels.

E. Label all disconnect switches in accordance with Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.

F. Fuse: All fuses shall be as indicated on the plan or as required by the equipment. Verify fuse size with equipment manufacturer requirements, prior to installation. Use current limiting fuses as indicated on plan. Provide one spare fuse cabinet in each electrical room with one complete set of spare fuses for all sizes of main fuses, subpanel fuses, HVAC equipment fuses and fire alarm.

G. Terminals shall be minimum 75 degree rated.

END OF SECTION

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SECTION 26 31 00 - PHOTOVOLTAIC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section:
   1. Specifies the furnishing/procurement, installation, connection, testing, and commissioning of solar energy electrical power generation systems.
   2. Applies to all sections of Division 48 related to solar energy electrical power generation systems.

B. Related Work:
   1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
   3. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
   4. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
   5. Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.
   6. Section 26 24 16, PANELBOARDS.
   7. Section 26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS: Requirements for enclosed disconnect switches.
   8. Section 26 33 00 – BATTERY EQUIPMENT.

1.3 DEFINITIONS

A. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE 100 CD.

B. Unless otherwise specified or indicated, solar energy conversion terms used in these specifications, and on the drawings, are as defined in ASTM E772.

1.4 SYSTEM DESCRIPTION

A. Provide materials, labor, equipment, installation, testing, services and incidentals necessary to install a complete solar PV system feeding AC power to the utility grid in accordance with IEEE 1547 and local utility regulations, and as shown on the approved drawings. The PV system must comply with these specifications, all applicable codes and standards, all construction documents, and all local AHJ’s.

B. Provide all necessary components and accessories for a complete, secure, and operational solar PV system, including:
   1. PV modules (framed)
   2. Inverters
   3. Overcurrent protection/combiner boxes (as applicable)
   4. DC and AC balance of systems, including raceways, boxes, gutters, enclosures, grounding, quick-connect electrical connectors, DC wiring and disconnects, AC wiring and disconnects and AC panelboard/switchboards (as applicable)
   5. Mounting/racking system and associated hardware, including structural supports system.
   6. Monitoring and Data Acquisition Systems (DAS)

1.5 SUBMITTALS AND SHOP DRAWINGS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Submit detailed information for components of the solar electrical generation system, including for those mentioned in Part 1.4.B. of this specification. This detailed information shall include rated capacities, operating characteristics, electrical characteristics, furnished specialties and accessories, and manufacturer warranty information.

C. Submit construction and shop drawings with sufficient information to demonstrate compliance with bridging documents and specifications. Include electrical ratings/capacities, dimensions, mounting details, installation and assembly details, materials, required clearances, terminations, weight, wiring and connection diagrams, accessories, and nameplate data. Include shop drawings for foundations and other support structures.

D. Submit a comprehensive Operation and Maintenance (O&M) manual for each system. Further information on the required contents of this manual as well as its format and organization can be found in Part 3.4.B of this specification.
   1. If changes have been made to the O&M manual originally submitted, then submit updated maintenance and operating manuals two weeks prior to the final inspection.

E. Submit certifications two weeks prior to final inspection, including the following:
   1. Certification by the manufacturers of all major items of the solar energy electric generation system that the system conforms to the requirements of the drawings and specifications, and that they have jointly coordinated and properly integrated their equipment and controls to provide a complete and functional installation.
   2. Certification by the Contractor that the solar energy electric generation system has been properly installed, adjusted, tested, commissioned, and warrantied. Contractor shall make all necessary field measurements and investigations to ensure that the equipment and assemblies meet contract requirements.

F. Submit copies of all applications and documentation provided to the serving utility related to interconnection and net metering required per CPUC Electric Rule 21. In all cases, the serving electric utility may have a requirement for further electrical studies, which may include (but are not limited to) power factor analysis, short circuit protection studies, grid wiring adequacy, or capacities of upstream equipment. If such requirements exist and are required by the serving electric utility and substantially increase interconnection costs or the ability to interconnect the project, the Contractor shall promptly notify the Owner and seek approval from Owner before

making any changes to the interconnect application. These additional utility requirements shall be fulfilled by the Contractor at the Owner's expense.

G. Provide written documentation confirming the utility's approval of the interconnection of the solar energy electrical power generation system with the utility system. The Contractor shall be responsible for all interconnection coordination, including review of any previous interconnect applications, utility company coordination, revisions to interconnect applications as-needed, inspections, and final approval for the complete interconnection of the PV systems with the utility company grid, including bi-directional utility meters at each location. The Contractor shall ensure that the design and construction does not void any tariff grandfathering achieved by the initial interconnect applications submitted with the utility.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. Underwriters Laboratories, Inc. (UL):
1. UL 467 - Standard for Safety Grounding and Bonding Equipment
2. UL 1703 – Standard for Flat-Plate Photovoltaic Modules and Panels
3. UL 1741 - Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources
4. UL 2703 – Standard for Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for use with Flat-Plate Photovoltaic Modules.

C. Institute of Electrical and Electronics Engineers (IEEE)
1. No. 929-2000 - Recommended Practice for Utility Interface of Photovoltaic (PV) Systems
2. No. 1547-2018 - Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces
3. IEEE Standards Dictionary: Glossary of Terms & Definitions (2009)

D. International Electrotechnical Commission (IEC)
1. No. 62446-1 - Photovoltaic (PV) Systems - Requirements for Testing, Documentation and Maintenance - Part 1: Grid Connected Systems - Documentation, Commissioning Tests and Inspection

E. ASTM International (ASTM)
1. No. E772-15 - Standard Terminology of Solar Energy Conversion
2. No. E2848-13 - Standard Test Method for Reporting Photovoltaic Non-Concentrator System Performance
3. No. E3010-15 - Standard Practice for Installation, Commissioning, Operation, and Maintenance Process (ICOMP) of Photovoltaic Arrays

F. American National Standards Institute (ANSI)
1. No. C12.1-16 - Electric Meters - Code for Electricity Metering

G. National Fire Protection Association (NFPA):
1. No. 70-2019 California Electrical Code (CEC), with State of California Amendments

H. National Electrical Manufacturers Association (NEMA):
   1. No. 250-14 - Enclosures for Electrical Equipment (1,000 Volts Maximum)

I. California Building Code (CBC), with State of California Amendments

J. California Energy Commission Title 24 Building Energy Efficiency Requirements

K. California Department of Forestry and Fire Protection, Office of the State Fire Marshal – Solar Photovoltaic Installation Guidelines

L. Local utility solar program guidelines, including net energy metering interconnection requirements, as applicable.

1.7 DELIVERY, STORAGE AND HANDLING

A. Storage of equipment for the job is the responsibility of the Contractor and shall be scheduled for delivery to the site, as the equipment is required. All materials shall be delivered new, undamaged and without defects. Damage to the equipment delivered to the site or in transport to the job shall be the responsibility of the Contractor.

B. All components shall be new and direct from the respective manufacturer; used or refurbished materials are not permitted.

C. Store solar PV modules in the original packaging according to the manufacturer's guidance and are to remain in packaging until the day of installation. If a solar PV module is removed from its packaging, store according to the manufacturer's guidance.

D. All equipment and panels shall be handled with care so as not to damage the delivered products. All equipment shall be installed in new and neat condition.

E. Appropriate protective clothing shall be worn when handling the equipment.

F. Where PV systems will be installed on a roof or overhead, all materials stored on the roof shall be distributed so as not to overload the roof at any point. All materials stored on roof shall follow the guidelines of the roofing system manufacturer including protection boards, pallets and/or mats to prevent damage to the roof system and insulation assemblies. All roof top construction, construction related traffic and staging areas shall have protection boards in place to prevent damage to the roofing system and insulation assemblies.

1.8 GUARENTEES

A. Materials and equipment shall be listed by an independent testing laboratory for the class of service intended (Underwriters Laboratories or equivalent).

B. Damaged equipment shall be repaired or replaced as necessary at no cost to the owner prior to final acceptance.

C. Guarantees shall be submitted to the owner, in writing, prior to final acceptance.

D. The installation, including labor, shall be warranted free of defects for a minimum of one year from date of owner final acceptance. Any defect related to the contractor's work, during the warrantee period, shall be corrected at the contractor's expense.

E. Equipment shall be warranted free of defects for a minimum of one year or as stated in this specification, whichever is a longer duration.
   1. PV Module Manufacturer's Special Minimum Power Output Warranty: Manufacturer agrees to repair or replace components of PV modules that fail to exhibit the minimum power output within specified warranty period. Special warranty, applying to modules only, applies to materials only, on a prorated basis, for period specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable system manufacturers/vendors shall be as specified on the associated electrical drawings of the Contract construction documents. Manufacturers shall provide their latest line of equipment, meeting all current industry standards, utility requirements and criteria set forth in the Contract. The Owner seeks equipment from proven, industry leading manufacturers in solid financial standing, producing "tier-one" financeable equipment.

B. Contractor proprietary products shall have an ICC report or a testing report stamped and signed by a licensed California engineer.

2.2 EQUIPMENT AND MATERIALS

A. PV modules shall meet the following:
   1. Solar PV module manufacturer, model, and number of modules must match the approved plans or substitutions may be allowed upon approval by the EOR.
   2. Module manufacturer that has produced no less than 250MW of modules in the prior year.
   3. Modules are from a field-tested product line that has been commercially available for no less than three years.
   4. Module manufacturer shall provide a 25-year warranty on the solar modules with at least 80 percent power output guaranteed at 25 years. The solar module manufacturer shall confirm that the warranty applies on an "as installed basis," i.e., the warranty will confirm the panels were installed according to its requirements and specifications for installation. Moreover, the manufacturer shall have a minimum 10-year product warranty that ensures the products will be free from defects in materials and workmanship. The warranty shall last for ten (10) years from the date of purchase. The glass shall not cloud or discolor; the cable and connector plug shall function. The aluminum frames shall not suffer damage due to freezing.
   5. Be the same manufacturer, the same size, the same wattage, and the same model.
   6. Have a minimum 25-year design life, designed for normal, unattended operation.
   7. UL 1703 listed.
   8. UL listed for the specified voltage (typically 1000 V-DC).
   9. Meet IEC 61215 (crystalline silicon PV modules) standards.
   10. Meet California SB1 Guidelines for Eligibility.

11. CEC Certification: PV Modules shall be CEC Certified and shall meet all the requirements for being eligible for CSI Incentives. PV modules and inverters shall be on the California Energy Commission (CEC) list of approved products. Refer to https://www.energy.ca.gov/programs-and-topics/programs/solar-equipment-lists. Modules shall have a minimum CEC PTC rating of 89% of the nameplate. PV modules shall have a minimum rating of 16.5 watts per square foot DC.
12. Each PV module shall include bypass diodes installed in the module junction box.

B. Inverters shall meet the following:
1. Inverter(s) manufacturer, model and quantities shall match as per the approved plans or substitutions may be allowed upon approval by the EOR.
2. String-type inverters with optimizer or add-on modules capable of providing rapid shut-down in accordance to CEC 690.12.
    a. All power optimizers shall be compatible with modules and inverters to provide a fully functional photovoltaic system.
3. Equipped with the following:
    a. Integrated DC input disconnect.
    b. Surge Protection
    c. Ground fault interrupter
    d. Data monitoring system
        1) System approved by the California Energy Commission that meets applicable state regulations.
4. Include a minimum 10-year warranty with options for 15 and 20 years.
5. Manufacturer produced no less than 250 MW of inverters in the prior fiscal year.
6. Field-tested product line that has been commercially available for no less than 2 fiscal years.
7. Comply with the following:
    a. UL 1741 listed, inclusive of UL 1741-SA requirements.
    b. IEEE 1547, including testing to IEEE 1547.1 and IEEE C62.45.
    c. IEEE C62.41.2.
    d. CPUC Electric Rule 21, California Energy Commission approved and utility line interactive type.
8. Incorporate disconnect switch for main DC power disconnect in compliance with applicable codes and utility requirements.
9. Sized as required to support the PV module production load within the rating of the equipment, together with all other components. Sizing shall not exceed 1.35 DC:AC ratio without approval by Owner and manufacturer.
10. Meet the following requirements:
    a. Nominal AC Voltage (Three-phase, + 10%): 208
    b. Nominal AC Frequency (+ 0.5 Hz): 60 Hz
    c. Line Power Factor (Above 20% rated power): >0.99
    d. AC Current Distortion (At rated power): <5% THD
    e. Maximum Open Circuit Voltage DC: 1,000 VDC
    f. Maximum Ripple Current (% of rated current): <5%
    g. Minimum Inverter Efficiency: >96%
    h. Temperature Range Ambient: -4º F to 122º F (-20º C to 50º C)
    i. Enclosure Environmental Rating (minimum): NEMA 3R (NEMA 4X within 5 miles of a marine environment or high dust area)
    j. Relative Humidity (non-condensing): 0-95%
    k. Sound level: <85 dBa

l. Capable of producing reactive power to operate between a power factor of 0.9 lagging to 0.9 leading (as adjusted on the inverter equipment).
m. Protective Functions: Standard wakeup voltage, wakeup time delay, shutdown power, shutdown time delay, AC over / under voltage and time delays, AC over / under frequency and time delays, ground over current, over-temperature, AC and DC over current, DC over voltage
n. User Display: Standard-LCD with on/off capability and physical screen cover or other means of protection from UV exposure.
o. DC Disconnect: 600 VDC load break rated (or higher where DC voltage is higher).
p. Seismic Rating appropriate for the site and installation method.
q. Internal combiner panel option to allow connections of sub-arrays at the Inverter without the use of additional equipment.

C. All equipment costs shall include all known and future duties, tariffs, export tariffs, customs, demurrage, and shipping costs.

D. No substitution for contracted equipment shall be made without the written consent of Owner and EOR.

E. Upon connection of the new PV systems, provide a placard on the respective Main Switchboard to identify the two sources of power feeding the equipment. Any existing signage related to legacy PV system shall be removed.

F. Combiner boxes (where used) shall be NEMA 3R rated (minimum, NEMA 4X shall be used within 5 miles of a marine environment) and shall include fuses for string inputs and a bus bar to combine the strings into sub-arrays, for input into the Inverter system. Minimum combiner box output bus ampacity shall be 156% of the rated short circuit current available to be carried on the bus (the sum from all strings to the bus).

G. All AC interconnecting feeders shall be sized per applicable sections of CEC Articles 310, 690 and 705. Conduit fill to 40% max. Include temperature derating as required for the ambient temperatures and roof conditions per CEC. Provide equipment grounding conductor in each conduit.

H. All roof and exterior mounted raceways shall be designed and installed to accommodate expansion and contraction due to heating affects, including adequate cable length and listed expansion couplings. All expansion couplings or installations shall include grounding bonding jumpers as required by code.

I. All AC circuits to be 3-wire or 4-wire + ground, as required by inverter manufacturer’s installation manual. All grounding per CEC 690, Part V.

J. All DC circuits and feeders sized to CEC table 310.15(B)(16) (90-degree column). Minimum ampacity shall be 156% of the rated short circuit current available to be carried on the specific conductor. Conduit fill to 40% max. Include temperature derating as required for the ambient temperatures and roof conditions per CEC, and conduit fill derating as required. Provide equipment grounding conductor in each conduit.

K. All DC circuits to be 2-wire + ground.

L. AC conductors in raceways shall be Type THWN-2 or XHHW-2 for wet and dry locations. AC conductors shall be installed in raceways.

M. DC PV string conductors shall be Type PV or USE-2/RHW-2 marked minimum 1000V and sunlight resistant. Exposed wiring shall be generally minimized and solely limited to the wiring immediately below the PV arrays.

N. Above ground exposed conduit shall be rigid galvanized steel with threaded fittings except where AHJ and other applicable codes or specifications specifically allow for the use of EMT conduit. All conduit shall meet CEC Code, AHJ Guidelines and any applicable standards. Exterior installations shall have watertight fittings. All conduit shall be rated for exposed installation and a minimum design life equivalent to the solar panels. Paint all visible exposed raceways and boxes mounted on the side of buildings to match adjacent surface finish after installation. Colors to be selected and approved by the Owner.

O. All interior conduit to be EMT with steel set-screw fittings (no cast fittings).

2.3 WIRE MANAGEMENT

A. All wiring methods must meet or exceed current industry standards for wire management, strain relief and fastening.

B. All DC string wire management shall use stainless steel or galvanized steel cable clips, Heyco or similar. UV rated cable ties shall be used minimally and only in locations where the use of cable clips is impossible.

C. Wiring shall not be routed over sharp edges of structural members, equipment or modules.

D. Wiring shall be routed under the modules of the array wherever possible to avoid direct exposure to the sun or elements.

E. Wiring shall be secured under the array so as to prevent excessive slack resulting in wire motion, and to minimize visibility of inter-module and home run wiring to the public.

F. Excess slack in the wire shall be secured such that it is in the module channel or secured to the junction box of the module. Factory-installed wire leads for modules can be wrapped around the junction box of the module.

G. Where exposed, wires, cables and conductors shall be managed in a neat and orderly manner. Where exposed to environmental conditions (e.g., sunlight, rain, wind, etc.) and visible from below, wires shall be fastened in a uniform and discrete fashion.

H. Strain relief and drip loops shall be utilized at all entrances to and from conduit bodies, junction boxes, weather heads, switchgear, inverters and panelboards etc. Conductors shall be strapped with strain relief as not to stress panel leads, home runs or mechanically crimped connections within the array. Sufficient slack shall be provided at both ends of cables to allow service and re-termination, and to prevent thermal expansion and contraction from stressing connections.

I. Wire in switchboards, panelboards, meter cabinets, pull boxes, and other cabinets shall be neatly grouped and tied in bundles with nylon ties rated for the temperature rating of the

electrical equipment at 10-inch intervals. In switchboards, panels and terminal blocks, wires shall be fanned out to terminals and trained for straight entry into the terminals. At no point shall nylon ties be used on bussing or bussing used in any manner to support other materials including but not limited to circuit conductors.

J. Maintain the conductor required bending radius per CEC and manufacturer specifications.

K. Wires shall not be installed until debris and moisture is removed from conduits, boxes, and cabinets. Wires stored at site shall be protected from physical damage until they are installed and walls are completed.

L. Wire-pulling compounds furnished as lubricants for installation of conductors in raceways shall be compounds approved and listed by UL, NRTL, or equal. Oil, grease, graphite, or similar substances are not permitted. When pulling conductors, do not exceed manufacturer's recommended values.

M. Conductor Color Codes
1. AC Circuits (<600V): Conductors must be color-coded by phase and voltage as required by CEC, the AHJ, and the utility.
2. DC Circuits, grounded: Positive-Red, Negative-White
3. DC Circuits, ungrounded: Positive-Red, Negative-Black
4. For phase and neutral conductors 6 gauge or larger, permanent thermoplastic-colored tape may be furnished to mark conductor end instead of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.

N. Conductor Identification
1. All conductors, including DC homerun circuits, shall be labeled at each point the conduit run is broken by a cabinet, box, gutter, etc. Where terminal ends are available, identification shall be by means of heat shrink wire markers.
2. Labels shall indicate circuit or string and phase in accordance with the project drawings.

O. Tape and Splice Kits
1. Wire splice kits shall be UL listed for their manner of use, such as direct burial or wet operation. Splices, joints, and connectors joining conductors in dry and wet locations shall be covered with listed insulation approved by the manufacturer for use with the splice, or as contained in the listed splice kit. Free ends of conductors connected to energized sources shall be taped.
2. Thermoplastic insulating material approved by UL, NRTL, or equal for installation as sole insulation of splices shall be furnished and shall be installed according to manufacturer's printed specifications. Standard electrical tape shall not be the sole insulation material for splices unless explicitly listed for use in the application and meeting the temperature rating of the insulation requirements for the splicing connection.

P. Terminations
1. Terminations of conductors shall be performed to the requirements and recommendations listed within the manufacturer manuals of the termination hardware and equipment where the termination shall occur.
2. Conductors shall be terminated with minimal exposure of the bare conductor.
3. Conductors cannot exceed the size and quantity restrictions of the lug. Contractor to verify equipment lugs supplied will accept the size and quantity of conductors shown in the project drawings.

4. Full engagement of the conductor within the lug must be maintained.
5. Provide necessary coating of anti-oxidation coating on all exposed conductor ends entering the lug.
6. Where mechanical connectors are used, torque all set-screws to manufacturer specifications with a calibrated torque wrench and indicate with torque marks. Torqueing electrical connectors "hand tight" is not allowed.
7. Where compression connectors are used, they must be installed with compression tools and dies approved by the manufacturer for use with the connector.
8. Ensure the final portion of the conductor before entering the termination is not part of a conductor bend (straight on entry).
9. Terminations of aluminum conductors cannot be made within 18 inches of earth/grade.
10. Termination fittings, connectors, and lugs must be rated and listed for the conductor metal type connected.

2.4 STRUCTURAL MOUNTING SYSTEMS AND GROUNDING

A. The system shall be installed as part of a structural support system designed for the application and approved by the AHJ.

B. Deviations from AHJ-approved construction drawings shall be documented with structural calculations and construction details; these engineering documents shall be submitted for AHJ approval prior to commencing any work.

C. All mounting systems shall result in the installation of a PV system that meets all local applicable seismic and wind-load requirements, with a safety factor of at least 1.5.

D. Array mounting hardware shall be compatible with the site considerations and environment. Special attention shall be paid to minimizing the risk from exposed fasteners, sharp edges, and potential damage to the modules or support structures, corrosion resistance, and durability of the mechanical hardware. The use of stainless-steel fasteners and aluminum support structures are required. The use of galvanized steel for the main support columns is acceptable and expected where metals come in contact with concrete. The use of wood is not acceptable.

E. All equipment shall be from a manufacturer specializing in production of roof attachment products and racking materials of the type specified with a minimum of 5 years documented experience. All items of a given type shall be the products of the same manufacturer.

F. The installation of solar systems on roofs shall adhere to the California State Fire Marshal Solar Photovoltaic Installation Guideline and California Fire Code requirements.

G. Flat and low slope roofs:
   1. Design shall minimize interrow shading.
   2. Panel tilt shall be a minimum of 5 degrees.

H. Roof attachments and stand-offs shall be installed per manufacturer’s requirements and attached to the roof structure per structural requirements and as otherwise described in the construction documents. Copies of the manufacturer’s mounting details and instructions shall be presented to the AHJ prior to installation. Moreover, attachments must be constructed in collaboration with the roofing manufacturer responsible for the roof and roofing material warranty to ensure that the roof warranty is not invalidated by the installation of the PV system.

I. Roof attachments shall be made with an approved sealant. Coordinate with Architect for roof penetration sealing requirements.

J. PV module attachment must be four-point equally distributed over the frame.

K. Bolts/Nuts/Washers to hold down panels must be Stainless Steel and 5/16 or larger (304 or 316).
   1. Bolt must use a locking system like (Blue Lock Tight or nylon lock nuts) in addition to lock washers.
   2. All nuts/bolt under 12’ from the ground and exposed to the public site shall be tamper proof (and approved by the AHJ).

L. End caps shall be provided on all structural tubing.

M. Hot galvanic coating shall be provided on all steel after all welding.

N. Permeate heavy duty fall protection anchors “D” rings for OSHA fall protection of cleaning crews where fall protection is required by OSHA.

O. All metal on the project except wires and wire connections shall be hot dipped galvanized, stainless steel, or anodized aluminum. (No Zinc coated, no painted, no uncoated hardware, bolts, bracing or braces is permitted.)

P. PV arrays shall be seismically restrained from falling off the roof or excessive movement on the roof. Panels shall be installed to resist sliding and pop-up resulting from lateral and vertical seismic forces and displacements per CBC.

Q. If PV modules are mounted to a racking system with module mounting clamps, the clamps must be approved for this purpose by their manufacturer as part of a UL 2703 listed assembly. Clamps shall be listed for PV module grounding to galvanized steel substrate, and their installation shall comply with the clamp installation manual and the PV module installation manual.

R. All PV modules shall be bonded to each other and to the racking system or canopy galvanized steel structural purlins with listed PV module grounding devices and equipment grounding conductors. For a racking system, provide bonding straps between individual rails joining to form a multi-piece railing system. Moreover, an equipment grounding conductor shall ground the PV array to the PV inverter ground bar.

S. Where PV modules and metallic parts of the racking system are grounded and bonded, contact between dissimilar metals such as copper and galvanized steel shall be avoided. Where contact cannot be avoided, outdoor-rated deox or conductive joint compound shall be applied between the interfacing metal surfaces.

2.5 SYSTEM ELECTRICAL

A. The modules shall be interconnected using cable assemblies. The pigtails shall be quick-connect electrical wiring connections rated for the application (90-degree rated). DC string connectors for homerun wires and jumpers provide by the Contractor must match the make and model of

the connectors supplied with the PV module, or must be UL listed as compatible with the connectors supplied with the PV module.

B. Raceway system shall be installed in a manner that prevents water from draining into electrical equipment.

C. All major components of the systems and the installation procedures shall meet CEC requirements, including Articles 690 and 705.

D. The PV system shall be designed to automatically drop offline when normal utility power is lost to avoid unintentional islanding effects as required by the local utility.

E. All electrical system equipment shall be properly rated to withstand and interrupt (in the case of over current protection devices) the available fault current at the point of use

F. All required overcurrent protection and electrical bussing sizes per CEC 690.

G. Means of system grounding to be approved by professional Electrical Engineer of record and GFCI protection shall be in accordance with CEC requirements.

H. Arc-fault protection where applicable per CEC 690.11.

I. Add Rapid shut-down capability as applicable in compliance with CEC 690.12 requirements (Rapid Shutdown of PV Systems on Buildings).

J. For PV system supply side interconnection (where applicable), the Contractor shall inspect the main service switchgear to confirm suitability of the switchgear supply side bus for interconnection of the PV system. Where required by the AHJ, any modification of the existing switchgear necessary to construct the supply side connection shall be approved by the switchgear manufacturer or a Nationally Recognized Testing Laboratory (NRTL). Where an NRTL approves modification of the switchgear, a field labeling report shall be provided to the Owner. The Contractor is responsible for obtaining switchgear manufacturer approval of any modification required to accommodate the supply side connection, or NRTL approval and report.

K. Outdoor grounding connections between dissimilar metals (such as aluminum lugs and copper wire) will be protected against galvanic corrosion by the application of outdoor-rated deox or conductive joint compound between the interfacing metal surfaces.

2.6 MISCELLANEOUS SYSTEM REQUIREMENTS

A. All exterior equipment to be sunlight and UV resistant as well as rated for elevated temperatures at which they are expected to operate (on roofs in hot sunlight).

B. No dissimilar metals are allowed to contact each other (use deox, joint compound, plastic or rubber washers). Best practices shall be used to avoid corrosion.

C. No aluminum in contact with concrete or masonry materials.

D. Bolted connections shall be non-corrosive and include locking devices designed to prevent twisting over the design life of the PV system.

E. Environmental impact of system equipment containing hazardous materials shall be disclosed, as well as maintenance and disposal instructions for equipment at the end of its useful life.

F. The system shall be unshaded. No panel or equipment from the solar array shall create a shadow on any panel from 9 am to 4:15pm in the months from November 1 to March 15, and from 8am to 5:30 pm in the months from March 16 to October 31.

2.7 SYSTEM METERS, MONITORING, AND DATA ACQUISITION SYSTEM (DAS)

A. Contractor shall provide the following monitoring instrumentation:
1. Production Meter – A PV system production meter measuring the output of the solar array on a minimum 15-minute interval.
2. Inverter Web Monitoring - Provide web monitoring module for each inverter (if multiple inverters are provided): factory installed module, detailed power data, energy output graphs for hourly, daily, weekly and monthly graphs of voltage vs. power output, data available for each inverter and the total system, energy output can be exported in spreadsheet format, online help.

B. All measurement equipment must be “revenue” grade.

C. Meters used shall be listed by the California Energy Commission.

D. AC Power/Energy (including current transformers): Accuracy ± 2%.

E. Data Acquisition and Monitoring System (DAS) shall be provided for all points of interconnect. The DAS shall include, but not be limited to, the measurement, calculation, display, and reporting of the following items:
1. PV production in 15-min reporting intervals.
2. Varying levels of summary data, including daily, weekly, monthly and yearly intervals.
3. A minimum of 1-year of 15-min interval data shall be downloadable in a single instance.
4. System electrical functions (instantaneous and accumulated power output (kW and kWh), AC and DC system voltage and amperage, and peak value tracking with associated time stamps).
5. Pounds of CO2 emissions avoided from the generation of PV energy at the site (compared to local utility fuel mix electric carbon content). CO2 avoidance factor shall be readily customizable for the local utility.
6. Capable of outputting data in the Western Renewable Energy Generation Information System (WREGIS) format sufficient for registering Renewable Energy Credits (RECs) from each system.
7. Lifetime logging and access to data reported by DAS, including database-level, "unprocessed" data for lifetime of system operation.
8. DAS shall provide access to all data through an open data exchange protocol (FTP Push or Application Program Interface (API)) to Owner and Owner’s Third-Party Designee at no additional cost. This data shall, at a minimum, include PV production data, inverter production data, inverter AC power data, inverter current data, inverter voltage data, and alarm status readings. All data shall be available over multiple timescales, ranging from 15-min intervals to annual intervals and shall include both real- time and historic data.

F. Contractor shall load software (as applicable) on Owner provided computers and train Owner in operation and maintenance of software or cloud-based systems and related monitoring functions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all equipment and all required wiring for a complete and operational system. Follow manufacturer's guidelines for the installation of the array components, including mounting hardware and PV modules. Provide required conductor terminations to devices for a complete system to function as specified and indicated. Complete installation must comply with all local building codes, manufacturer's instructions, and applicable industry standards.

B. Prior to system start-up, ensure no copper wire remains exposed with the exception of grounding wire as allowed in certain circumstances per manufacturer’s instructions.

C. In seismic areas, systems shall be adequately anchored and braced per details on structural contract documents to withstand seismic forces at the locations where installed.

D. Wiring Installation: Workers shall be made aware that photovoltaic modules will be live and generating electricity when there is any ambient light source and shall take appropriate precautions. Utilize on-site measurements in conjunction with engineering designs to accurately cut wires and layout before making permanent connections. Locate wires out of the way of windows, doors, openings, and other hazards. Ensure wires are free of snags and sharp edges that have the potential to compromise the wire insulation. All cabling shall be mechanically fastened. If the system is roof-mounted it shall have direct current ground fault protection according to CEC. Ensure breakers in combiner box are in the off position (or fuses removed) during combiner box wiring.

E. Instrumentation: Install instruments as recommended by the manufacturer. Locate control panels inside a room accessible only to qualified persons.

F. Rack-Mounted Photovoltaic Installations: Rack-mounted photovoltaic modules shall be installed in accordance with the manufacturer’s installation instructions.

G. Remove, replace, patch, and repair existing roofing materials and surfaces cut or damaged during installation of the solar energy electrical power generation system, by methods and with materials so as not to void roofing system warranty. Notify roof warrantor before proceeding.

H. Provide safety signage per CEC.
   1. All placards shall be machine generated phenolic type with red background and white lettering, affixed to equipment with stainless steel screws or with permanent adhesive where set screws are not feasible. Minimum lettering size to be 1/4" unless otherwise noted or required for legibility.
   2. In addition to CEC required signage, provide utility-required system directory placard and utility safety switch identification placard as required by local utility company, to identify all system components.

3. All DC disconnects, Junction boxes, DC feeders, AC feeders and termination points shall be labeled. Labeling shall match the as-built plans or drawings provided at the completion of the project. All conduits shall have voltages label at each end and no less than 10’ apart labeling on all Electrical equipment. Contractor shall pay for and install all Arc flash protection labeling on all equipment they touch.

I. Utility Interconnection:
   1. The Contractor shall complete the submissions for the utility interconnection agreement with the Owner’s approval. The Contractor shall submit the required authorization form with the utility to act on behalf of the Owner. In the event that the Owner has already submitted interconnection applications, the Contractor shall take all responsibility for the interconnect process upon contract execution. The Contractor shall promptly review any past applications and begin coordination with the Utility for any proposed modifications to the system design. The Contractor shall ensure that any tariff grandfathering or other milestone achieved by the initial application is maintained. Should an issue arise that may jeopardize tariff grandfathering, some other utility milestone, substantially increase interconnection costs or the ability to interconnect the project, the Contractor shall promptly notify the Owner and seek approval from Owner before making any changes to the interconnect application.
   2. The PV system at each Site shall not be interconnected with the Utility’s distribution facilities until written authorization from the Utility Company has been obtained. Unauthorized interconnections may result in injury to persons and damage to equipment or property for which the installing contractor may be liable.

3.2 TESTING

A. Photovoltaic modules shall be tested in the factory for design performance and results shall be included in the Operation and Maintenance manuals.

B. Inverters shall be factory tested for performance and the results shall be included in the Operation and Maintenance manuals.

C. System testing of the installed photovoltaic array shall be performed on all system strings and recorded in commissioning documentation and the Operation and Maintenance manuals.

D. Performance testing to ASTM E2848-13 standard. Contractor shall define methodology within the protocol and obtain Owner's acceptance and notify owner before performing testing.

E. Commissioning of PV Systems shall adhere to IEC 62446-1 requirements and shall include the following at a minimum:
   1. Conductors
      a. AC & DC conductor inspection / megger. Insulation resistance and DC hi-pot testing of each AC and DC conductor, phase-to-phase and phase-to-ground.
      b. Wire management check
      c. DC string polarity, Voc & Isc testing and recording.
      d. Confirm all conduits & junction boxes are installed properly/watertight.
   2. Inspection of DC fusing and disconnects.
   3. Inspection of AC components: AC Disconnect, Main Switch Board, AC Combiner Panel Boards, Breakers, Fuses, Terminations, Phasing, OCPD operation, etc.
   4. Grounding & bonding system inspection and continuity testing

5. Inverters
    a. Inverter inspections and tests per manufacturer instructions.
    b. Inverter start-up and confirm proper inverter settings.
    c. Inverter output tests - Confirm PV system AC output as expected based on design, insolation and inverter readings.
6. IV Curve Trace, Performance testing and recording.
7. Thermal Imaging
    a. Check all electrical components while systems are energized.
    b. Spot check, Modules, Inverters, Disconnects, AC system, etc.
8. Torque spot check on mechanical and electrical terminations
9. Inspection of corrosion control measures.
10. Confirm signage and placards meet plans.
11. Workmanship evaluation.
12. Inspection of DAS / CT metering and monitoring equipment.
13. Confirm web-based monitoring interface operations.
14. Commissioning of any other major electrical infrastructure installed on the project per manufacturer requirements.

F. Testing to be performed per CPUC Electric Rule 21 testing procedures and requirements. All testing to be done on “no-cloud” days to avoid system fluctuation by passing clouds. Contractor to provide all testing and certification / commissioning.

G. System start-up procedure shall be as outlined by the Manufacturer’s Installation Manual(s).

H. Clean all equipment and PV modules prior to system start-up. PV modules shall be brush-cleaned with soap and water, and thoroughly rinsed.

3.3 TRAINING

A. Provide full instructions to designated District personnel in the system’s operation, maintenance, and programming. Training shall be specifically oriented to installed equipment and systems. Minimum (2) 2-hour trainings.

3.4 DOCUMENTATION

A. All commissioning and testing reports shall be provided to the Owner within 15 days of completion of testing.

B. The Contractor shall submit to the Owner a comprehensive Operations and Maintenance (O&M) manual for each system. O&M Manuals shall be compiled as a single, bookmarked portable document format (PDF) file. The document shall be a well-organized, comprehensive and custom document created with details for each site. The document shall include at a minimum the following:
    1. System description and overview
    2. Simplified site plan that shows array naming convention, inverter locations, and disconnects
    3. Safety Details, including shut down procedures
    4. Contact information for the system installer and maintenance personnel
    5. Monitoring system login and operation details

6. Standard procedures for both Owner and O&M personnel
7. Maintenance information, including schedules and responsibilities for ongoing maintenance
8. Troubleshooting and repair, including responses to typical issues and responsible parties
9. Summary table with the following details for each site: Site, System Size, Permission-to-Operate (PTO), Commercial Operation Date (COD), Final Completion Date, AHJ Closeout Date
10. Any other information that may be required for the Owner to easily and safely interact with, confirm performance, troubleshoot, maintain and/or service the materials and equipment installed under this Contract.
11. O&M Attachments shall include:
    a. Permission-to-Operate (PTO) notice and any other pertinent Utility documentation
    b. As-built Record Drawings in PDF fomrat (single compiled file for each site), provided as separate file from the fully compiled O&M Manual PDF. The updated as-built drawings shall also include the following details:
        1) DC string maps with corresponding inverter nomenclature (ID), locations, serial numbers, azimuth, and tilt.
        2) Data logger make, model and serial number
    c. Material List - Complete material list of all items furnished and installed, including but not limited to the following: PV Modules, inverters, wiring, combiner boxes, panelboards, switch gear, optimizers, disconnects, boxes, metering and DAS equipment.
    d. All warranties, cut sheets, and manuals for major equipment.
    e. System testing and commissioning documentation.

3.5 FINAL ACCEPTANCE

A. The acceptance of the solar PV system occurs only after all deficiencies identified by the performance tests and commissioning report are corrected and the system operates successfully during a 30-day initial testing period.

B. The Owner must sign appropriate certificates, if equipment and systems are operating satisfactorily in accordance with the specifications, stating the system's operation has been tested and accepted at the end of the final start-up and testing.

END OF SECTION

SECTION 26 33 00 – BATTERY EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section:

1. Specifies the design, engineering, furnishing, installation, connection, testing, and commissioning of battery energy storage systems (BESS).

B. Related Work:

1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

2. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

3. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

4. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.

5. Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.

6. Section 26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS: Requirements for enclosed disconnect switches.

7. Section 26 31 00 - PHOTOVOLTAIC SYSTEMS.

1.3 DESCRIPTION

A. Provide design, engineering, materials, labor, equipment, installation, testing, services and incidentals necessary to obtain required building permits from the Authority Having Jurisdiction (AHJ) and install a complete battery energy storage system feeding AC power to the utility grid in accordance with IEEE 1547 and local utility regulations. The PV system and associated battery energy storage system must comply with these specifications, all applicable codes and standards, all construction documents, and all local AHJ’s.

B. Provide a BESS integrated to the photo-voltaic system inverter complete and suitable for outdoor use, sized as follows:

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C. The minimum required system size as required per California Title 24 2022 Building Energy Efficiency Standards Section 140.10 for the Building type/use. The intended system size is as indicated in the associated electrical construction documents.

D. Locate the BESS as indicated on associate electrical plans.

E. Provide a fully integrated battery energy storage system in compliance with 2022 California Building Energy Efficiency Standards section 140.10 and Reference Joint Appendix JA12, and able to operate in parallel and tandem with the grid-tied PV system (either via AC or DC coupling).

F. It is the intent of these specifications to ensure that the installed system is consistent with and adheres to any and all California Building Codes and standards, the California Energy Commission's Solar Equipment List, and applicable utility rules and tariffs.

G. The system shall be designed by a licensed electrical engineer and installed by a licensed electrical contractor.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Submit detailed information for components of the electrical storage and generation systems. This detailed information shall include rated capacities, operating characteristics, electrical characteristics, furnished specialties and accessories, and manufacturer warranty information.

C. Submit certifications two weeks prior to final inspection, including the following:

1. Certification by the manufacturers of all major items of the solar energy electric generation system and battery storage system that the system conforms to the requirements of the drawings and specifications, and that they have jointly coordinated and properly integrated their equipment and controls to provide a complete and functional installation.

2. Certification by the Contractor that the solar energy electric generation system has been properly installed, adjusted, tested, commissioned, and warrantied. Contractor shall make all necessary field measurements and investigations to ensure that the equipment and assemblies meet contract requirements.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. Underwriters Laboratories, Inc. (UL):

1. UL 467 - Standard for Safety Grounding and Bonding Equipment

2. UL 1741 - Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

C. Institute of Electrical and Electronics Engineers (IEEE)

1. No. 929-2000 - Recommended Practice for Utility Interface of Photovoltaic (PV) Systems

2. No. 1547-2018 - Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces

3. IEEE Standards Dictionary: Glossary of Terms & Definitions (2009)

D. ASTM International (ASTM)

1. No. E772-15 - Standard Terminology of Solar Energy Conversion

2. No. E2848-13 - Standard Test Method for Reporting Photovoltaic Non-Concentrator System Performance

3. No. E3010-15 - Standard Practice for Installation, Commissioning, Operation, and Maintenance Process (ICOMP) of Photovoltaic Arrays

E. National Fire Protection Association (NFPA):

1. No. 70-2022 California Electrical Code (CEC), with State of California Amendments

F. National Electrical Manufacturers Association (NEMA):

1. No. 250-14 - Enclosures for Electrical Equipment (1,000 Volts Maximum)

G. California Building Code (CBC), with State of California Amendments

H. California Energy Commission Title 24 Building Energy Efficiency Requirements

1.6 DELIVERY, STORAGE AND HANDLING

A. Storage of equipment for the job is the responsibility of the Contractor and shall be scheduled for delivery to the site, as the equipment is required. All materials shall be delivered new, undamaged and without defects. Damage to the equipment delivered to the site or in transport to the job shall be the responsibility of the Contractor.

B. All components shall be new and direct from the respective manufacturer; used or refurbished materials are not permitted.

C. All equipment shall be handled with care so as not to damage the delivered products. All equipment shall be installed in new and neat condition.

D. Appropriate protective clothing shall be worn when handling the equipment.

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PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Only products that are listed, tested, identified, or labeled by UL, FM, ETL, or another Nationally Recognized Testing Laboratory shall be used as components in the project. Non-listed products are only permitted for use as project components when a comparable useable listed component does not exist. Non-listed products proposed for use as components must be identified as such in all submittals.

B. Battery Energy Storage System:

1. Per 2022 California Building Energy Efficiency Standards section 140.10(b), all buildings that are required by Section 140.10(a) to have a PV system shall also have a battery storage system meeting the minimum qualification requirements of Reference Joint Appendix JA12. The battery system rated energy capacity and the rated power capacity shall be not less than the values as determined by the equations present in section 140.10(b).

2. The primary function of the battery storage system is daily cycling for the purpose of load shifting, maximized solar self-utilization, and grid-harmonization. The system to be provided is not intended to support off-grid/back-up power capabilities.

3. Battery storage system shall be certified to the California Energy Commission's Solar Equipment List.

4. The battery storage system shall be tested in accordance with the applicable requirements given in UL1973 and UL9540. Inverters used with battery storage systems shall be tested in accordance with the applicable requirements in UL1741 and UL1741 Supplement A.

5. Shall meet or exceed the following:
   a. Single Charge-discharge cycle AC to AC (round-trip) efficiency of at least 80 percent.
   b. Energy capacity retention of 70 percent of nameplate capacity after 4,000 cycles covered by a warranty, or 70 percent of nameplate capacity under a 10-year warranty.

6. Control Requirements:
   a. The battery storage system shall have the capability of being remotely programmed to change the charge and discharge periods.
   b. During discharge, the battery storage system shall be programmed to first meet the electrical load of the facility. If during the discharge period the electrical load of the facility is less than the maximum discharge rate, the battery storage system shall have the capability to discharge electricity into the grid upon receipt of a demand flexibility signal from the local utility or a third-party aggregator.
   c. At the time of inspection, the battery storage system shall be installed to meet one of the control strategies listed in Reference Joint Appendix JA12.

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7. The battery storage system and the associated components, including inverters, shall comply with all applicable requirements specified in Rule 21 and Net Energy Metering (NEM) rules as adopted by the California Public Utilities Commission (CPUC).

8. Energy Storage System Manufacturers: Sol-Ark, Fortress Power, or engineer approved; energy code compliant equal.

C. System Electrical:

1. Systems (wiring, component, raceways, and connections) must be suited for conditions for which they are to be installed. If selected battery(ies) are not rated NEMA 3R or better and are installed in exterior locations, then they shall be installed in all-weather NEMA 4X enclosures.

2. AC conductors in raceways shall be Type THWN-2 or XHHW-2 for wet and dry locations. AC conductors shall be installed in raceways.

3. All AC circuits to be 3-wire or 4-wire + ground, as required by inverter manufacturer's installation manual. All grounding per CEC 690, Part V.

4. DC circuit conductors installed in raceways shall be Type THWN-2 or XHHW-2 for wet and dry locations Conductors shall be listed for use with BESS system voltage (I.E. 1000V).

5. All DC circuits and feeders sized to CEC table 310.15(B)(16) (90-degree column). Minimum ampacity shall be 156% of the rated short circuit current available to be carried on the specific conductor. Conduit fill to 40% max. Include temperature derating as required for the ambient temperatures and equipment location conditions per CEC, and conduit fill derating as required. Provide equipment grounding conductor in each conduit.

6. All DC circuits to be 2-wire + ground.

7. Above ground exposed conduit shall be rigid galvanized steel with threaded fittings except where AHJ and other applicable codes or specifications specifically allow for the use of EMT conduit. All conduit shall meet CEC Code, AHJ Guidelines and any applicable standards. Exterior installations shall have watertight fittings.

8. All roof and exterior mounted raceways shall be designed and installed to accommodate expansion and contraction due to heating affects, including adequate cable length and listed expansion couplings. All expansion couplings or installations shall include grounding bonding jumpers as required by code.

9. All interior conduit to be EMT with steel set-screw fittings (no cast fittings).

10. Raceway system shall be installed in a manner that prevents water from draining into electrical equipment.

11. All electrical system equipment shall be properly rated to withstand and interrupt (in the case of over current protection devices) the available fault current at the point of use

12. All required overcurrent protection and electrical bussing sizes per CEC 690.

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13. Means of system grounding to be approved by professional Electrical Engineer of record and GFCI protection shall be in accordance with CEC requirements.

2.2 WIRE MANAGEMENT

A. All wiring methods must meet or exceed current industry standards for wire management, strain relief and fastening.

B. Strain relief and service loops shall be included at enclosure entrances to and from conduit bodies, junction boxes, weather heads, switchgear, inverters, and panelboards etc. Conductors shall be strapped with strain relief as not to stress panel leads. Sufficient slack shall be provided at both ends of cables to allow service and re-termination, and to prevent thermal expansion and contraction from stressing connections.

C. Conductor Color Codes
1. AC Circuits (<600V): Conductors must be color-coded by phase and voltage as required by CEC, the AHJ, and the utility.
2. DC Circuits, grounded: Positive-Red, Negative-White
3. DC Circuits, ungrounded: Positive-Red, Negative-Black
4. For phase and neutral conductors 6 gauge or larger, permanent thermoplastic-colored tape may be furnished to mark conductor end instead of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.

D. Conductor Identification
1. All conductors, including DC circuits, shall be labeled at each point the conduit run is broken by a cabinet, box, gutter, etc. Where terminal ends are available, identification shall be by means of heat shrink wire markers.

E. Tape and Splice Kits
1. Wire splice kits shall be UL listed for their manner of use, such as direct burial or wet operation. Splices, joints, and connectors joining conductors in dry and wet locations shall be covered with listed insulation approved by the manufacturer for use with the splice, or as contained in the listed splice kit. Free ends of conductors connected to energized sources shall be taped.
2. Thermoplastic insulating material approved by UL, NRTL, or equal for installation as sole insulation of splices shall be furnished and shall be installed according to manufacturer's printed specifications. Standard electrical tape shall not be the sole insulation material for splices unless explicitly listed for use in the application and meeting the temperature rating of the insulation requirements for the splicing connection.

F. Terminations
1. Terminations of conductors shall be performed to the requirements and recommendations listed within the manufacturer manuals of the termination hardware and equipment where the termination shall occur.
2. Conductors shall be terminated with minimal exposure of the bare conductor.
3. Conductors cannot exceed the size and quantity restrictions of the lug. Contractor to verify equipment lugs supplied will accept the size and quantity of conductors shown in the project drawings.
4. Full engagement of the conductor within the lug must be maintained.
5. Provide necessary coating of anti-oxidation coating on all exposed conductor ends entering the lug.

6. Where mechanical connectors are used, torque all set-screws to manufacturer specifications with a calibrated torque wrench and indicate with torque marks. Torquing electrical connectors "hand tight" is not allowed.
7. Where compression connectors are used, they must be installed with compression tools and dies approved by the manufacturer for use with the connector.
8. Ensure the final portion of the conductor before entering the termination is not part of a conductor bend (straight on entry).
9. Terminations of aluminum conductors cannot be made within 18 inches of earth/grade.
10. Termination fittings, connectors, and lugs must be rated and listed for the conductor metal type connected.

2.3 STRUCTURAL ATTACHEMENT

A. The system shall be installed as part of a structural support system designed for the application as detailed on associated construction documents and approved by the AHJ.

B. Conduit penetrations of structure shall be minimized where possible.

2.4 EQUIPMENT REQUIREMENTS

A. BESS shall be a fully integrated energy storage solution – hybrid inverter, battery, and controller.

B. BESS shall have a self-contained enclosure with built-in temperature control and fire suppression system.

C. BESS shall utilize Lithium Iron Phosphate Batteries modules. BESS shall accept the quantity of battery modules to achieve the storage capacity as specified.

D. BESS warranty shall be minimum of 10 years.

E. BESS workmanship warranty shall be a minimum of 10 years.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all equipment and all required wiring for a complete operational system. Follow manufacturer's guidelines for the installation and interconnections.

B. Provide required conductor terminations to devices for a complete system to function as specified and indicated. Complete installation must comply with all local building codes, manufacturer's instructions, and applicable industry standards.

C. All systems must be installed in accordance with all applicable requirements of local electrical codes and the California Electrical Code (CEC).

D. Prior to system start-up, ensure no copper wire remains exposed with the exception of grounding wire as allowed in certain circumstances per manufacturer’s instructions.

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E. In seismic areas, systems shall be adequately anchored and braced per details on structural contract documents to withstand seismic forces at the locations where installed.

3.2 TESTING

A. Battery modules shall be tested in the factory for design performance and results shall be included in the Operation and Maintenance manuals.

B. Inverters shall be factory tested for performance and the results shall be included in the Operation and Maintenance manuals.

C. System testing of the installed BESS shall be performed and recorded in commissioning documentation and the Operation and Maintenance manuals.

D. System start-up procedure shall be as outlined by the Manufacturer’s Installation Manual(s).

E. The local enforcement agency shall verify that all Certificate of Installations are valid for the solar and battery energy storage systems. The battery storage systems shall be verified as a model certified to the Energy Commission as qualified for credit as a battery storage system. In addition, the enforcement agency shall verify that the battery storage system is programmed and operational with one of the controls listed in Joint Appendix JA12.The programmed control strategy at system final inspection and commissioning shall be the strategy that was used in the Certificate of Compliance.

3.3 OPERATION AND MAINTENANCE

A. As part of the acceptance of the solar PV system, the Solar/BESS installing contractor shall demonstrate satisfactory operation of the system. Provide a hard copy of the complete operations manuals and instructions on how to operate and safely disconnect (shut down) the BESS system.

B. Contractor shall provide two (2) two-hour trainings for owner’s personnel that will service equipment.

END OF SECTION

SECTION 26 33 23 – CENTRAL BATTERY EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SYSTEM DESCRIPTION

A. Modular battery source inverter system complete with charger, transfer mechanism and output circuit breakers.

B. Inverter output, sine wave, 60 Hz.

C. Provide two classes of output, one continuously energized, one energized only upon failure of input source.

1.3 SUBMITTALS

A. Provide product data for all elements of the system including batteries.

B. Shop drawings include battery interconnection schematic diagrams, block diagrams of interconnection of internal elements, input terminals and output circuit breakers.

C. Manufacturer's installation instructions.

D. Contract Closeout Submittals:
   1. Modify Project Record Documents to indicate location of installation and supply branch circuit.
   2. Provide complete operation and maintenance data.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver cabinet and electronic components to project for installation in sequence of work and termination of line and load branch circuit raceways.

B. Cover cabinet to prevent entrance of dust during construction.

C. Deliver batteries to project only when system is capable of being energized and the batteries connected to the chargers. Do not store wet charged batteries without connecting to a charging system.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Yorklite MAC Series, Lithonia, or approved.

2.2 COMPONENTS

A. Cabinet:
1. Welded steel, 12 and 14 gauge, constructed to NEMA-1 Specifications. Front and back accessibility.
2. Corrosion resistant paint finish.
3. High density polyethylene shelf liners.

B. Inverter Modules:
1. 1000VA independently replaceable slideout modules.
2. Lamp to indicate inverter operation.
3. Each module protected against reverse battery polarity.
4. Each module includes an encapsulated ferroresonant transformer, UL Class H insulation.

C. Charger:
1. Dual rate design. Constant current voltage limited high-rate charge followed by a precision float voltage charge for maximum battery capability and life.
2. Capable of fully recharging batteries with 12 hours following any rated discharge.
3. Reverse polarity protected.
4. Provide fuse protection for system DC input and charger AC input and DC output.

D. Monitor:
1. Monitor AC input for brownout or failure condition. Transfer to battery source when AC input voltage drops below 80 percent of nominal voltage.
2. Transfer time 30 to 80 milliseconds.
3. Low battery voltage shutdown set at 87.5 percent of nominal voltage.

E. Return to Normal Source: 2-minute time delay return to normal source once normal source has been reestablished.

F. Batteries: Long life, low maintenance lead-calcium with 1/4-inch plate thickness.

G. Output:
1. 120-volt 60 Hz plus or minus 1 Hz.
2. Voltage regulation, plus or minus 5 percent or less from 0 percent to 100 percent of rated load.

2.3 ACCESSORIES

A. Battery Shelf: Acid resistant roll-out shelf with integral stops and safety chain.

B. Status and Alarm Condition Monitor:
1. Indicator LEDs:

a. Normal source.
b. Inverter status.
c. Charger fuse.
d. Charger, high rate.
e. Charger, trickle.
f. Low battery voltage.
g. Electrolyte low level alarm.

2. Test switch.
3. Audible alarm with silence switch to monitor charger and inverter malfunctions and battery electrolyte level.
4. Digital panel meter, plus or minus percent accuracy, indicates AC and DC voltage, AC amps of load and DC amps of battery during inverter operation.

C. Output circuit breakers as indicated on Drawings.

D. Factory start-up service provided by inverter manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Level dry protected area with stable temperature conditions.

B. Comply with manufacturer's recommendations prior to start-up to prevent physical and electrical damage to components.

3.2 SCHEDULES

A. Provide output circuit schedule indicating loads connected to each output circuit breaker.

END OF SECTION

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SECTION 26 51 00 – INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Interior lighting systems, including luminaires, lamps and emergency lighting equipment.

B. Related Work:
   1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.
   3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.
   4. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
   5. Section 26 56 00, EXTERIOR LIGHTING.
   6. Section 26 56 70, LIGHTING ACCEPTANCE TESTING.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Shop Drawings:
   1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
   2. Include electrical ratings, dimensions, mounting, details, materials, terminations, wiring and connection diagrams, photometric data, ballasts, luminaires, lamps and controls.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM).

C. American National Standards Institute (ANSI).

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D. Aluminum Association Inc. (AA).

E. Illuminating Engineering Society of North America (IESNA).

F. National Electrical Manufacturers Association (NEMA).

G. National Fire Protection Association (NFPA).

H. Underwriters Laboratories, Inc. (UL).

1.5 DEFINITIONS

A. Lighting terminology used herein is defined in IES.

B. Exception: The term “driver” is used herein to cover both drivers and power supplies, where applicable.

C. Clarification: The term “LED light source(s)” is used herein per IES to cover LED package(s), module(s), and array(s).

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be in accordance with CEC, UL, ANSI, and as shown on the drawings and specified.

2.2 LIGHTING FIXTURES (LUMINAIRES)

A. Shall be in accordance with NFPA 70 (CEC), UL 1598 and shall be as shown on drawings and as specified. All luminaires shall have been certified to the California Energy Commission by its manufacturer to comply with the efficiency standards as per California Code of Regulations Title 24, Part 6, Section 111 referencing the Appliance Efficiency Regulations in Title 20. Post certification with building permit.

B. Sheet Metal:
   1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.
   2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
   3. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
      a. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.

C. Luminaires shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers.

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D. Recessed fixtures shall be of the type approved for the ceiling and insulation conditions and appropriate for the installation location. Insulation must be held back from the fixture to provide manufacturers' recommended clearances for proper operation. Thermal tripping shall be the installer's responsibility to correct. Where installed in fire rated ceilings, coordinate installation of fire rated enclosures around the ceiling penetrations. Fixtures shall contain the proper through wiring capacity for that which is shown on the plans.

E. Recessed fixtures shall be provided with the appropriate trims and hardware compatible with the ceiling type shown. Plaster frames are required where plaster or gypsum board ceilings are encountered.

F. Fixtures with louvers or light transmitting panels shall have hinges, latches and safety catches to facilitate safe, convenient cleaning and relamping. Vapor tight fixtures shall have pressure clamping devices in lieu of the latches.

G. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

H. Metal Finishes:
   1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.
   2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise specified on the drawing.
   3. Exterior finishes shall be as shown on the drawings.

I. Provide all lighting fixtures with a specific means for grounding metallic wireways and housings to an equipment grounding conductor.

J. Light Transmitting Components for Luminaires:
   1. Shall be 100 percent virgin acrylic plastic or water white, annealed, crystal glass.
   2. Flat lens panels shall have not less than 1/8 inch of average thickness. The average thickness shall be determined by adding the maximum thickness to the minimum unpenetrated thickness and dividing the sum by 2.
   3. Unless otherwise specified, lenses, diffusers and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking.

K. Light fixtures shall be manufactured specifically for the lamp type installed (specified) with ballasts or drivers integral to the fixture. Assemblies designed to retrofit fixtures are prohibited except when described in this fashion. Fixtures shall be designed for lamps as specified.

L. Provide wire lamp guard on all exposed lamp fixture/luminaires.

M. Provide fixtures with a U.L. listing for shower or shower rating above shower or tub areas.

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2.3 LED LUMINAIRE REQUIREMENTS

A. General Requirements:
1. Luminaire shall have an external label per ANSI C136.15
2. Luminaire shall have an internal label per ANSI C136.22.
3. Luminaires shall start and operate in -20°C to +40°C ambient.
4. LED light source(s) and driver(s) shall be RoHS compliant.

2.4 LED DRIVER

A. Driver
1. Rated case temperature shall be suitable for operation in the luminaire operating in the ambient temperatures as indicated.
2. Shall accept the voltage or voltage range indicated, and shall operate normally for input voltage fluctuations of plus or minus 10 percent. Consistent with NEMA SSL 1.
3. Shall have a minimum Power Factor (PF) of 0.90 at full input power and across specified voltage range.

B. Electromagnetic interference
1. Shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
2. Shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.

C. The following shall be in accordance with corresponding sections of ANSI C136.37
1. Wiring and grounding
2. All internal components shall be assembled and pre-wired using modular electrical connections.
3. Mounting provisions
4. Terminal blocks for incoming AC lines
5. Latching and hinging
6. Ingress protection

2.5 LAMPS

A. Provide lamps for all luminaires.

B. LED LIGHT SOURCE
1. Minimum Color Rendering Index (CRI): 60.
2. Correlated Color Temperature (CCT)
a. CCT shall be as listed in Table 1 below:

Table 1. Allowable CCT

Manufacturer-Rated Nominal CCT (K)	Allowable LM-79 Chromaticity Values Measured CCT (K)
2700	2580 to 2870
3000	2870 to 3220
3500	3220 to 3710
4000	3710 to 4260

4500	4260 to 4746
5000	4745 to 5311
5700	5310 to 6020
6500	6020 to 7040

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation and furnishing of lighting fixtures shall be in accordance with the CEC, manufacturer's instructions and as shown on the drawings or specified. Fixtures damaged in transit and storage prior to completion shall be replaced at Contractor’s expense.

B. Align, mount and level the lighting fixtures uniformly.

C. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Architect. The Architectural reflected ceiling plan will take precedence over electrical plans.

D. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings.

E. Lighting Fixture Supports:
1. Contractor shall provide support for all of the fixtures independent of suspended ceilings. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
2. Shall maintain the fixture positions after cleaning and relamping.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
4. Hardware for recessed fluorescent fixtures:
5. Fixtures shall be supported as detailed on drawings and as required by DSA standards.
6. Installation: Fixtures shall be securely mounted on ceilings and walls with appropriate fastening devices. "Drop-in" type T-bar fixtures shall be secured with #12 gauge safety "earthquake wires" as described by California Code of Regulations Title 24 Part 2, Chapter 47. "Earthquake clips" will be required for fastening to the T-bar system in addition to safety wire. Surface mounted fluorescent fixtures shall be solidly screwed or clipped into framing above drywall with 4-#10 sheet metal screws into each fixture. Provide blocking for screw supports behind all surface mounted lighting fixtures weighing more than 15 lbs.
7. Surface mounted lighting fixtures:
    a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts shall be minimum ¼-20 bolt, secured to structural ceiling. Non-turning studs may be attached to the building structure by 12 gauge safety hangers.
8. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
9. Single or double pendent mounted lighting fixtures:
    a. Each stem shall be supported by an approved outlet box, mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved

equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure and be allowed to swing to a 45 degree angle.

10. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.

F. Furnish and install the specified lamps for all lighting fixtures as part of this project.

G. Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.

H. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

I. At completion of project, relamp all fixtures which have failed/burned-out lamps. Clean all fixtures, lenses, diffusers and louvers that have accumulated dust/dirt during construction.

J. Provide unswitched leg of interior lighting branch circuit to integral emergency battery pack light fixtures, exit signs and night lights as applicable per lighting plans.

K. Wallmount fixtures in walkway areas shall not project more than 4 inches from wall when projection occurs lower than 80 inches.

END OF SECTION

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SECTION 26 56 00 – EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of exterior luminaires, controls, poles and supports.

1.2 RELATED WORK

A. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.

C. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

E. Section 26 51 00, INTERIOR LIGHTING.

F. Section 26 56 70, LIGHTING ACCEPTANCE TESTING.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Shop Drawings:
   1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
   2. Include electrical ratings, dimensions, mounting, details, materials, required clearances, terminations, wiring and connection diagrams, photometric data, ballasts, poles, luminaires, effective projected area (EPA), lamps and controls.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM).

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C. American Concrete Institute (ACI).

D. American National Standards Institute (ANSI).

E. Aluminum Association Inc. (AA).

F. Illuminating Engineering Society of North America (IESNA).

G. National Electrical Manufacturers Association (NEMA).

H. National Fire Protection Association (NFPA).

I. Underwriters Laboratories, Inc. (UL).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Poles: Do not store poles on ground. Store poles so they are at least one foot above ground level. Do not remove factory-applied pole wrappings until just prior to installation of pole.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be in accordance with CEC, UL, ANSI, as shown on the drawings and as specified.

2.2 POLES

A. General:
   1. Poles shall be steel or aluminum as specified in fixture schedule and as shown on the drawings. Finish shall be as approved by the Architect. Assume custom color for bidding.
   2. The pole and arm assembly shall be designed for wind loading of 100 miles per hour, with an additional 30 percent gust factor, supporting luminaire(s) having the effective projected areas indicated as per manufacturer data.
   3. Poles shall anchor-bolt type designed for use with underground supply conductors. Poles shall have gasketed handhole with a minimum clear opening of 2.5” x 5”. Handhole cover shall be secured by stainless steel captive screws.
   4. Provide a steel grounding stud opposite hand hole openings.

B. Provide a base cover matching the pole in material and color to conceal the mounting hardware pole-base welds and anchor bolts.

C. Hardware: All necessary hardware shall be 300 series tamperproof stainless steel.

D. Types:
   1. Aluminum: Provide aluminum poles manufactured of corrosion resistant AA AAH35.1 aluminum alloys conforming to AASHTO LTS-4 for Alloy 6063-T6 or Alloy 6005-T5

for wrought alloys, and Alloy 356-T4 (3,5) for ASTM B108-01 cast alloys. Poles shall be seamless extruded or spun seamless type. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Base covers for aluminum poles shall be cast from 356-T6 aluminum alloy in accordance with ASTM B108-01.

2. Steel: Provide steel poles having minimum 11-gage steel with minimum yield/strength of 48,000 psi and iron-oxide primed factory finish. Base covers for steel poles shall be structural quality hot-rolled carbon steel plate having a minimum yield of 36,000 psi.

2.3 FOUNDATIONS FOR POLES

A. Foundations shall be cast-in-place concrete.

B. Foundations shall support the effective projected area of the specified pole, arm(s), luminaire(s), and all accessories specified under wind conditions as specified in this section.

C. Place concrete in spirally wrapped treated paper forms for round foundations, and construct forms for square foundations.

D. Rub-finish and round all above-grade concrete edges to approximately 1/4” radius unless otherwise detailed. Leave no exposed voids or aggregate.

E. Concrete shall have 3000 psi minimum 28-day compressive strength.

F. Anchor bolt assemblies and reinforcing of concrete foundations shall be as shown on the drawings and meet ACI 318. Anchor bolts shall be in a welded cage or properly positioned by the tie wire to stirrups.

G. After leveling of pole grout base solid between plate and footing with dry pack concrete for vibration reduction.

2.4 LUMINAIRES

A. UL 1598 and ANSI C136.17. Luminaries shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and ballast heat and safe cleaning and relamping.

B. Light emitting diode (LED)-based solid state lighting (SSL) products shall be factory tested in accordance to the International Engineering Society (IES) LM-79 recommendations and meet ANSI C78.377-2008 standards.

C. LED light sources shall be factory tested in accordance to IES LM-80 recommendations.

D. LED-based SSL product shall incorporate an external heat sink, integral to the luminaire.

E. IESNA HB-9 and RP-8 light distribution pattern types shall be as indicated on the drawings.

F. Incorporate associated ballasts and drivers within the luminaire housing.

G. Lenses shall be frame-mounted heat-resistant, borosilicate glass, prismatic refractors. Attach the frame to the luminaire housing by hinges or chain.

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H. Pre-wire internal components to terminal strips at the factory.

I. Bracket mounted luminaries shall have leveling provisions and clamp type adjustable slip-fitters with locking screws.

J. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.

K. LED-based SSL luminaires shall be manufactured specifically for LED lamps with drivers integral to the luminaire housing.

2.5 LAMPS

A. Luminaires shall be listed for the lamp specified on the associated electrical plans. Install the proper lamps in every luminaire installed.

B. Lamps shall be clear or coated as recommended by luminaire manufacturer to provide for maximum luminaire efficiency in fixture used.

2.6 LED-BASED SOLID STATE DRIVERS

A. Shall be listed by either U.L. or equal listing agency and comply with IEEE C.62.41-1991, Class A operation.

B. Provide a minimum power factor of 0.9.

C. Minimum operating temperature appropriate for outdoor environments.

D. Shall operate at a frequency greater than or equal to 120Hz.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lighting in accordance with the CEC, as shown on the drawings, and in accordance with manufacturer’s recommendations.

B. Poles:
1. Provide pole foundations with galvanized steel anchor bolts, threaded at the top end and bent 1.57 rad 90 degrees at the bottom end. Provide galvanized nuts, washers, and ornamental covers for anchor bolts. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath and the end of conduit elbow. Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.
2. After the poles have been installed, shimmed and plumbed, grout the spaces between the pole bases and the concrete base with non-shrink concrete grout material.
3. Attach pole base cover to pole flange with set screws.

C. Foundation Excavation: Depth shall be as indicated on drawings. Dig holes large enough to permit the proper use of tampers to the full depth of the hole. Place backfill in the hole in 6" maximum layers and thoroughly tamp. Place surplus earth around the pole in a conical shape and pack tightly to drain water away.

D. Photocell Switch Aiming (where applicable): Aim switch according to manufacturer's recommendations. Mount switch on or beside each luminaire when switch is provided in cast weatherproof aluminum housing with swivel arm or set adjustable window slide for proper footcandles photocell turn-on.

3.2 GROUNDING

A. Ground noncurrent-carrying parts of equipment including metal poles, luminaries, mounting arms, brackets, and metallic enclosures as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or alloyed connectors suitable and listed for this purpose.

END OF SECTION

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SECTION 26 56 70 - LIGHTING ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. The Contractor shall be responsible for the Certificate of Acceptance, but coordinate with the Certified California Lighting Controls Test Technician to assure that all required documents have been filed with and approved by the enforcement agency prior to receiving a final occupancy permit. The Certificate of Acceptance will indicate that the Contractor has demonstrated acceptance requirements of the plans and specifications, that current requirements for installation certificates are met, and that currently required operating and maintenance information (as well as the Certificate of Acceptance) were provided to the building Owner.
   2. Testing, evaluation and calibration of lighting controls equipment provided, installed and connected in Division 26.
   3. Documentation of test results, completion of “Certificate of Acceptance” and “Certificate of Installation” forms and filing with the enforcement agency for approval.
   4. Specific Jobsite Conditions:
      a. Acceptance testing must be tailored for each specific design, job site, and climactic conditions. While the steps for conducting each test remain consistent, the application of the tests to a particular site may vary. The Contractor shall review the construction documents and include all required time, material, testing equipment, etc. as required to complete the requirements of this section.

B. Related Work:
   1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 51 00, INTERIOR LIGHTING.
   3. Section 26 56 00, EXTERIOR LIGHTING.
   4. Section 26 09 43, NETWORK LIGHTING CONTROLS SYSTEM.
   5. Section 26 09 00, CONTROLS AND INSTRUMENTATION.
   6. Section 26 09 23, OCCUPANCY SENSORS.

1.3 REFERENCES

A. Acceptance Testing Criteria: 2016 Building Energy Efficiency Standards Non-Residential Compliance Manual.

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1.4 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. All material, equipment, labor and technical supervision to perform tests, calibrations and documentation specified herein.

B. Scope of Testing, Evaluation and Calibration (as applicable):
   1. Automatic (master) time switches.
   2. Occupancy sensors.
   3. Automatic daylighting controls.
   4. Photo electric sensors.
   5. Daylighting controls.
   6. Outdoor astronomical time switches.
   7. Area controls.

1.5 SUBMITTALS

A. Test Reports:
   1. Written record of all tests and completion of forms included in this section.
   2. At completion of project, assemble a final test report. Submit report to the enforcement agency and the Owner prior to final occupancy to include:
      a. Summary of project.
      b. Description of systems and equipment tested.
      c. Visual inspection report.
      d. Description of tests.
      e. Test results.
      f. Conclusions and recommendations.
   3. Report shall be bound in booklet form, include on the Contractor’s letterhead the title of the report and the systems tested.

B. Constructability Plan Review
   1. The Contractor shall review the construction drawings and specifications to understand the scope of the acceptance tests and raise critical issues that might affect the success of the acceptance tests prior to starting construction. Any constructability issues associated with the lighting system should be forwarded to the design team for review/modifications prior to equipment procurement and installation. The Contractor shall submit on company letterhead, with the lighting control equipment required by Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL, 1.4B, a letter confirming that the constructability review has been completed and their company has reviewed and is prepared to complete the lighting acceptance testing required by this section.

PART 2 - PRODUCTS

2.1 FORMS

Lighting Installation forms and verification procedures for lighting systems that require acceptance testing can be downloaded from the www.energy.ca.gov website.

A. Lighting Acceptance forms are to be provided by a Certified California Lighting Controls Acceptance Test Technician. The California Energy Commission adopted changes to the California building Efficiency Standards (Title 24, Parts 1 and 6) that require lighting controls and devices to be certified as properly installed and operational, prior to issuance of occupancy permits. All Acceptance Technicians must be employed by an Acceptance Test employer that provides support as well as quality control. Certified California Lighting Controls Acceptance Test Technicians can be found at the following website: www.calctp.org/acceptance-technicians/contractors

B. These completed forms will be the deliverable product to the enforcement agency and Owner as described in 1.4 of this section.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Tests:
   1. Contractor's Responsibilities:
      a. Perform all required tests required by this section.
      b. Schedule testing with building Owner.
      c. Provide Installation forms.
      d. Acceptance forms provided by California Certified Lighting Controls Technician hired by Contractor.
      e. Calibration of equipment such as light meters, photo electric controls, etc.
      f. Programming of time switches (interior/exterior lighting) for operations as directed by the Owner.

3.2 ADJUSTING

A. Final Settings: The Contractor shall be responsible for implementing all final settings and adjustments on controls equipment as required for a complete and operating system.

END OF SECTION

SECTION 27 13 00 - INTERCOMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
   1. Telecommunications Cabling at the new or remodeled buildings for the project. Backbone and horizontal cabling comprised of copper and fiber cabling, and support systems are covered under this document.
   2. The Horizontal (workstation) Cabling System shall consist of a minimum of three (3) 4-pair Unshielded Twisted Pair (UTP) Copper Cables to each work area outlet unless otherwise noted for specific locations. The cables shall be installed from the Work Area Outlet to the Telecommunications Room (TR) located on the same floor, and routed to the appropriate rack serving that area and terminated as specified in this document.
   3. The Audio/Video Cabling System is comprised of digital (HDBase-T) or analog cabling associated with point-to-point Audio/Video, specific to projectors, televisions, loudspeakers and presentation spaces. Where Category 6A (Cat6A) “STP” or “F/UTP” cabling is specified, cables shall consist of a single 4-pair Foil over Unshielded Twisted Pair (F/UTP) Copper Cables with the capability to operate at or above 10 Gbps.
   4. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications contractor as detailed in this document.
   5. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types will be provided as an attachment to this document. If the bid documents are in conflict, this specification shall take precedence. The successful vendor shall meet or exceed all requirements for the cable system described in this document.

1.3 REGULATORY REFERENCES

A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the local Electrical Code and present manufacturing standards.

B. All materials shall be UL Listed and shall be marked as such. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

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C. All modular jacks, patch cords, consolidation point, and patch cords performance shall be verified (not just tested) by a third party to be category 6A component and channel compliant.

D. The cabling system described in this is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:
1. ANSI/TIA/EIA - 568-C.0, Generic Telecommunications Cabling for Customer Premises
2. ANSI/TIA/EIA - 568-C.1, Commercial Building Telecommunications Cabling Standard.
3. ANSI/TIA/EIA - 568-C.2, Balanced Twisted Pair Cabling Components, Addendum 1 –
4. ANSI/TIA/EIA - 568-C.3, Optical Fiber Cabling Components
5. ANSI/TIA/EIA – 569-A, Commercial Building Standard for Telecommunications Pathways and Spaces, February, 1998.
6. ANSI/TIA/EIA – 606-A, Administration Standard for Telecommunications Infrastructure of Commercial Buildings, February, 2002.
7. ANSI/TIA/EIA – 607-A, Commercial Building Grounding and Bonding Requirements for Telecommunications, August, 1994.
8. ANSI/ TIA/EIA – 758, Customer-Owned Outside Plant Telecommunications Cabling Standard, April 1999.
9. BICSI - TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM) – Current Edition.
10. National Fire Protection Agency (NFPA – 70), National Electrical Code (NEC) –2002.

E. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.

F. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

1.4 APPROVED CONTRACTOR

A. The Telecommunications Contractor must be a Certified Installer for the products and/or system being supplied. A copy of certification documents must be submitted with the quote in order for such quote to be valid. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with said certification. At least (1) for every (3) members of the copper installation and termination crew must be certified to a Technician Level of training by the product manufacturer or BICSI. At least (1) for every (5) members of the optical fiber installation and termination crew must be certified by the product manufacturer or other approved organizations in Optical Fiber installation and termination practices.

1.5 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The Telecommunications contractor will provide and install all of the required material to form a complete system.

B. The work shall include, but not be limited to the following:
   1. Furnish and install a complete telecommunications wiring infrastructure as described on the plans and in these specifications.
   2. Furnish, install, and terminate all UTP and Optical Fiber cable.
   3. Furnish and install all wall plates, jacks, patch panels, and patch cords.
   4. Furnish and install all required cabinets and/or racks as required and as indicated.
   5. Furnish any other material required to form a complete system.
   6. Perform link testing (100% of horizontal and/or backbone links) and certification of all components.
   7. Furnish test results of all cabling to the owner on disk and paper format, listed by each closet, then by workstation ID.
   8. Adhere and comply with all requirements of the product certification and warranty programs (sufficient to be able to provide and extend the manufacturer's extended warranty).
   9. Provide owner training and documentation. (Testing documentation and As-built drawings).

1.6 SUBMITTALS

A. Under the provisions of this request for proposal, prior to the start of work the telecommunications contractor shall:
   1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
   2. Submit proof from manufacturer of contractor's good standing in manufacturer's program.
   3. Submit appropriate cut sheets and samples for all products, hardware and cabling with highlighted or otherwise denoted specific products to be used. If product cut-sheets are submitted without specific products highlighted the engineer shall return submittal immediately with "Revise and Resubmit" response.

B. Work shall not proceed without the Owner's approval of the submitted items.

C. The telecommunications contractor shall receive approval from the Owners on all substitutions of material. No substituted materials shall be installed except by written approval from the Owner.

1.7 QUALITY ASSURANCE

A. The telecommunications contractor shall staff the project with qualified personnel. All products shall be new and in good condition.

1.8 DELIVERY, STORAGE AND HANDLING

A. Delivery and receipt of products shall be at the site described in the Scope Section.

B. Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored

outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable shall be stored off site at the contractor's expense.

C. If the telecommunications contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.

1.9 DRAWINGS

A. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the telecommunications contractor in bidding the job. The telecommunications contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.

B. The telecommunications contractor shall verify all dimensions at the site and be responsible for their accuracy.

C. Prior to submitting the bid, the telecommunications contractor shall call the attention of the Engineer to any materials or apparatus the telecommunications contractor believes to be inadequate and to any necessary items of work omitted.

PART 2 - PRODUCTS

2.1 EQUIVALENT PRODUCTS

A. The Owner and engineer have selected specific products that achieve the desired level of performance and preference. The project has been designed around said products. Proposed substitutions must demonstrate equivalent performance in all areas to the satisfaction of the Owner and must be submitted for review at least 10 days prior to bid. The Owner shall not be required to entertain substitutions submitted after bid.

2.2 WORK AREA OUTLETS

A. Work area cables shall each be terminated at their designated work area location in the connector types described in the subsections below. Included are modular telecommunication jacks. These connector assemblies shall snap into a faceplate.

B. The Telecommunications Outlet Assembly shall accommodate:
   1. A minimum of three (3) modular jacks, arranged into (1) 1-gang faceplate by Leviton (no substitutions). Cable and Jack shall be blue in color.
   2. Additional accommodations for specific locations as noted in the plans for optical fiber and/or additional copper cables as necessary.
   3. A blank filler (matching in color to indicated faceplate color) will be installed when extra ports are not used.
   4. All modular jacks shall have their circuit number on the faceplate identifier strip.

5. Multiple jacks that are identified in close proximity on the drawings (but not separated by a physical barrier) may be combined in a single assembly. The telecommunications contractor shall be responsible for determining the optimum compliant configuration based on the products proposed.
6. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the telecommunications contractor shall submit the proposed configuration for each outlet assembly for review by the Owner.
7. The modular jack shall incorporate printed label strip on the dust cap module for identifying the outlet. Printed labels shall be permanent and compliant with ANSI/TIA/EIA–606-A standard specifications. Labels shall be printed using a printer such as a Brady hand held printer. Hand printed labels shall not be accepted.

C. Faceplates: The faceplates shall:
1. Be as appropriate to fit the modular jack used.
2. Be UL listed and CSA certified.
3. Be constructed of high impact, ABS plastic UL 94V-0 construction (except where noted otherwise).
4. Shall be Off-White in color.
5. Be compliant with the above requirements along with the following when incorporating optical fiber:
    a. Be a low profile assembly,
    b. Incorporate a mechanism for storage of cable and fiber slack needed for termination,
    c. Position the UTP modular jack to face downward or at a downward angle
    d. Position the fiber optic couplings to face downward or at a downward angle to prevent contamination and,
    e. Incorporate a shroud that protects the optical couplings from impact damage.
6. Be available as single-gang or dual-gang.
7. Provide easy access for adds, moves, and changes by front removal of jack modules.
8. Possess recessed designation windows to facilitate labeling and identification.
9. Include a clear plastic cover to protect labels in the designation window.
10. Have mounting screws located under recessed designation windows.
11. Comply with ANSI/TIA/EIA-606-A work area labeling standard.
12. Allow for the UTP modules to be inverted in place for termination purposes.
13. Be manufactured by an ISO 9001 registered company.
14. Acceptable products as follows (no substitutions will be allowed):
    a. Leviton Quickport 41081 Series angled 4-port faceplate compatible with Leviton modular jacks.
    b. Leviton Quickport 41084 Series blank modules where a blank filler is required. Match faceplate color.

D. Voice / Data Jacks (Telecommunications Jacks)
1. Voice/Data jacks, also known as telecommunications jacks, shall be 8-position modular jacks and shall be Category 6A performance as defined by the references in this document including ANSI/TIA/EIA-568-C.2. All pair combinations must be considered, with the worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory.
2. The modular jack shall use dual reactance modular contact array.
3. The modular jack shall be both component, link and channel compliant to category specifications in ANSI/TIA/EIA-568-C.

4. The modular jack's performance shall be third-party verified to ANSI/TIA/EIA-568-C Category 6A specifications.
5. The modular jack shall have low emission IDC contacts.
6. The modular jack shall use standard termination practice using 110 impact tool or manufacturer approved tool using trained technician.
7. The modular jack shall be backwards compatible to Category 3, 5, 5e, and 6.
8. The modular jack shall be center tuned to category 6A test specifications.
9. Dust covers shall be used on each termination.
10. Design/make: Leviton QuickPort (6110G series) or approved equal.

2.3 110 COPPER TERMINATION BLOCK

A. The voice cross connect shall be a passive connection between the horizontal termination blocks and the backbone termination blocks. The wall mount frames shall be field terminated kits including all blocks, connecting blocks, and designation strips. Management rings shall be mounted between vertical columns of blocks to provide management of cross-connect wire. Backbone and horizontal blocks shall use 4-pair connecting blocks. Blocks shall be oriented so that backbone terminations are located on the left and horizontal frames are located on the right of the termination field when facing the frame assembly.

B. 110 Block Kits shall:
1. Include both the wiring block in a 50, 100 and 300 pair (as applicable) footprint and the connecting block.
2. Be manufactured using fire retardant molded plastic.
3. Support termination of 22-24 AWG solid conductor.
4. Contain back openings for the feed through of cable.
5. Meet category 6 component compliance and be verified by a third-party nationally recognized independent testing laboratory.
6. Have color-coded tips on the wiring block and color-coding on the connector blocks for installation identification.
7. Use standard termination practice requiring a single conductor 110 impact tool, or manufacturer approved methods.
8. Termination hardware shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
9. Be backwards compatible to category 3, 5 and 5e.
10. Be labeled in compliance with ANSI/TIA/EIA-606-A labeling specifications using permanent labels and LabelMo software (or other labeling software/printer).
11. Be manufactured by an ISO 9001 registered company.

2.4 MODULAR PATCH PANELS

A. The Modular Patch Panels shall:
1. Meet category 6A component compliance and be verified by a third-party nationally recognized independent testing laboratory.
2. Use low emission IDC contacts.
3. Use dual reactance technology to enhance the signal-to-noise ratio.

4. Require standard termination practices using a 110 impact tool or manufacturer approved methods. Where modular jacks are used, EC shall use patch panel that accepts modular jacks as specified in Section 2.2(D) above.
5. Use a single piece IDC housing designed to accept larger Category 6A conductors.
6. Support both T568B and T568A wiring.
7. Include easy to follow wiring labels.
8. Include label fields.
9. Allow for the use of icons.
10. Include full length metal rear cable management.
11. Be available in standard or high density.
12. Be backward compatible to category 3, 5, 5e, and 6.
13. Be center tuned to category 6A test specifications.
14. Be a maximum of 48-ports in any given 2 rack-units
15. Design/make Leviton 49255-H48, patch panel compatible with Leviton QuickPort modular jacks

2.5 RACKS

A. All racks and wire management shall be of one manufacturer or designed specifically to work together. The equipment rack shall provide vertical cable management and support for the patch cords at the front of the rack and wire management, support, and protection for the horizontal cables inside the legs of the rack. Waterfall cable management shall be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. Wire management shall also be mounted above each patch panel and/or piece of equipment on the rack. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack. Velcro cable ties shall be provided inside the rack channels to support the horizontal cable. Rack shall be black in color to match the patch panels and cable management.

B. Free-Standing Rack
   1. Free-standing rack shall:
      a. Provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-C.
         1) Rear channels to securely route distribution cables.
         2) Vertical management “cage” to protect patch cords while allowing easy access for moves, adds and change with individual 1-rack unit fingers and double hinged door.
         3) Include speednuts to reduce assembly time.
      b. Have top cable trough with waterfall and built in patch/horizontal cable distribution separator.
      c. Have EIA hole pattern on front and rear.
      d. Have rack units stamped on the front, on both sides allowing numbering from top-to-bottom or bottom-to-top.
      e. Be available with a 10.5” or 16.25” channel depth.
      f. Be available with hook and loop straps for securing bulk cables inside the vertical U-channels.
      g. Assemble as 19” (483 mm) or 23” (584 mm) with no additional hardware.
      h. Be available with three styles of vertical patch cord management: interbay with latches, cable management rings, or fingerduct with covers.

i. Provide floor and ceiling access for cable management and distribution.
j. Provide pre-drilled base for floor attachment of rack.
k. Be available in a 7 foot version (45 rack units).
l. Be available in standard color of black.
m. Be manufactured by an ISO 9001 registered company.
n. Acceptable products as follows:
1) Chatsworth #46353-703, 45-RU 2-post rack, black (or approved equal).

2.6 HORIZONTAL DISTRIBUTION CABLE

A. All horizontal data station cable and voice cable shall terminate on modular patch panels (copper or fiber), 110 cross-connecting blocks (copper), or patch/splice cabinets (fiber) in their respective Telecommunications Room or Equipment Room as specified on the drawings.

B. 100 OHM Category 6A UNSHIELDED TWISTED PAIR CABLE (UTP)
1. Physical Characteristics:
a. Shall be plenum or riser rated and meet applicable requirements of ANSI/ICEA S-80-576. If plenum, all 4 pairs must be insulated with F.E.P. No 2 x 2 or 3 x 1 constructions will be allowed.
b. The diameter of the insulated conductor shall be .023 in. maximum.
c. Shall consist of (4) twisted pairs.
d. Shall be suitable for the environment in which they are to be installed.
e. The color coding of pairs shall be per T-658B color coding scheme:

Pair 1	Pair 2	Pair 3	Pair 4
W-BL; BL	W-O; O	W-G; G	W-BR; BR

f. The overall diameter of the cable shall be no larger than 0.320”nominal.
g. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
h. Cable shall withstand a bend radius of 1” at -20 degrees Celsius without jacket or insulation cracking.
i. Cable shall be third party verified to meet ANSI/TIA/EIA-568-C.2.
2. Transmission Characteristics:
a. DC resistance of any conductor shall not exceed 9.38 Ohms per 100m max. at 20°C. Measured in accordance with ASTM D 4566.
b. The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 4.4 Nf.
c. DC resistance unbalance between any two conductors of any pair shall not exceed 3% when measured at or corrected to 20°C in accordance with ASTM D 4566.
d. The capacitance unbalance to ground at 1 kHz of any pair shall not exceed 330 pF per 100m.
3. Acceptable products as follows:
a. Cable shall be Berk-Tek LANmark-10G2 UTP or approved equal.
b. Cable installed underground/below slab in conduit shall be Berk-Tek LANmark-10G2 OSP (when used solely in wet location) or approved equal.

C. 100 OHM Category 6A SHIELDED TWISTED PAIR CABLE (F/UTP)
1. Physical Characteristics:
a. Shall be plenum or riser rated and meet applicable requirements of ANSI/ICEA S-80-576. If plenum, all 4 pairs must be insulated with F.E.P. No 2 x 2 or 3 x 1 constructions will be allowed.

b. The diameter of the insulated conductor shall be .023 in. maximum.
c. Shall consist of (4) twisted pairs.
d. Shall be suitable for the environment in which they are to be installed.
e. The color coding of pairs shall be per T-658B color coding scheme:

Pair 1	Pair 2	Pair 3	Pair 4
W-BL; BL	W-O; O	W-G; G	W-BR; BR

f. The overall diameter of the cable shall be no larger than 0.320”nominal.
g. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
h. Cable shall withstand a bend radius of 1” at -20 degrees Celsius without jacket or insulation cracking.
i. Cable shall be third party verified to meet ANSI/TIA/EIA-568-C.2.

2. Transmission Characteristics:
a. DC resistance of any conductor shall not exceed 9.38 Ohms per 100m max. at 20°C. Measured in accordance with ASTM D 4566.
b. The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 4.4 Nf.
c. DC resistance unbalance between any two conductors of any pair shall not exceed 3% when measured at or corrected to 20°C in accordance with ASTM D 4566.
d. The capacitance unbalance to ground at 1 kHz of any pair shall not exceed 330 pF per 100m.

3. Acceptable products as follows:
a. Cable shall be Berk-Tek LANmark-MD751 Cat 6A FTP solid CMR-CMX Outdoor rated with PVC jacket.

2.7 FIBER OPTIC CABLE

A. Indoor/Outdoor Optical Fiber Non-Conductive Loose Tube with Laser Enhanced 9/125um Optical Fibers
1. Each Singlemode Fiber shall be:
a. Graded-index optical fiber wave-guide with nominal 9/125um-core/cladding diameter, OS2 or better industry rating.
b. The fiber shall comply with the latest revision of ANSI/EIA/TIA-4920000.
c. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-46, 53 or 61.
d. Information transmission capacity shall be measured in accordance with the latest revision of ANSI/EIA/TIA-455—204.
e. The measurements shall be performed at 23 degrees C +/- 5 degrees.
f. Maximum attenuation dB/Km @ 1310/1550 nm: 0.4/0.3.
g. Optical Fiber shall be laser optimized and guarantee Gigabit Ethernet distances of >5000m for 1310nm and 10 Gigabit Ethernet distances of >5000m for 1310nm.

2. Physical Characteristics:
a. Shall be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
b. Shall be suitable for use in risers, and horizontal applications.
c. Shall have a dry water blocking system for cable core and buffer tubes.
d. Shall be available with a fiber strand count range from 6 to 72.
e. Shall have a 3.0 mm sub-unit diameter.
f. Shall have and be marked with an UL-OFNR and OFN FT6 Flame Rating.
g. Shall comply with the requirements of ICEA S-83-596 & ANSI/ICEA S-87-640.

h. Strength members shall be dielectric and may be either fiberglass or aramid yarn.
i. Suitable for underground or aboveground conduits.
j. Loose Tube fibers shall be color coded in accordance with EIA / TIA 598 with an overall dark blue jacket.
k. Shall have a ripcord for overall jacket.
l. Suitable for operation between -40° to +75° C.
m. Shall be UV resistant.
n. Shall be of an all dielectric design.
o. Shall have a maximum installation tension of 300 lbs for cables without dielectric strength member and 600 lbs for cables with dielectric strength members.

3. Design Make:
   a. Berk-Tek Adventum 12-strand and 24-strand, OS2 optical fiber cable with 9/125 micron fiber or approved equal.

2.8 FIBER OPTIC CONNECTORS

A. LC Fiber Optic Connectors
1. Each LC Fiber Connector shall:
   a. Be a pre-polished fiber connector with a fiber stub or field-polish fiber connector.
   b. Be available in single mode and multimode versions.
   c. Have a domed zirconia ferrule.
   d. Be a flat polish type connector.
   e. Accept a nominal fiber diameter of 125 micrometers.
   f. Have a typical insertion loss of 0.1 dB for multimode and 0.1 dB for single mode.
   g. Have repairable tips.
   h. Have an insertion loss change of less than 0.2 dB after 500 reconnects.
   i. Be stable over an operating range of –40C to +75 degrees C.
2. Design Make:
   a. Leviton LC Fiber Optic Connectors on pre-terminated pig-tails or approved equal.
   b. Fiber optic pigtails shall be fusion spliced only in submitted and approved fiber optic splice trays and enclosures.

2.9 COPPER CABLE PROTECTION UNITS

A. All copper circuits shall be provided with protection between each building with an entrance cable protector panel. All building-to-building circuits shall be routed through this protector. The protector shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the TC ground point. Approved manufacturer of protection units is Porta Systems.

2.10 PATCH CORDS

A. The contractor shall provide factory terminated and tested UTP and optical fiber patch cords and equipment cords for the complete cabling system. The UTP patch cables shall meet the requirements of ANSI/TIA/EIA-568-B for patch cord testing.

B. Copper (UTP) patch cords shall:

1. Use 8-position connector with impedance matched contacts and designed using dual reactance.
2. Be constructed of 100 ohm, 4 pair stranded conductor, unshielded twisted pair copper per the requirements of the ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.2–1 standard.
3. Meet TIA category 6A component specifications in ANSI/TIA/EIA-568-B.2-1
4. 100% factory tested to meet category 6A performance and
5. ETL or any other nationally recognized 3rd party verification
6. Be center tuned to category 6A performance specifications by using paired bi-level contact array.
7. Be capable of universal T568A or T568B wiring schemes.
8. Modular connector shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
9. Have a performance marking indelibly labeled on the jacket (by the manufacturer).
10. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606-A labeling specifications.
11. Have “snagless” protection for the locking tab to prevent snagging and to protect locking tab in tight locations and provide bend relief.
12. Be available in three standard colors.
13. Be available in 3 foot, 5 foot, 7 foot, 9 foot, and 15 foot standard lengths.
14. Be backwards compatible to Category 3, 5, 5e, and 6.
15. Be manufactured by an ISO 9001 registered company.

C. Copper (F/UTP) patch cords shall:
1. Use 8-position connector with impedance matched contacts and designed using dual reactance, with a foil shield encompassing the circumference of the cable, along the entire cable length.
2. Be constructed of 100 ohm, 4 pair stranded conductor, shielded twisted pair copper per the requirements of the ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.2–1 standard.
3. Meet TIA category 6A component specifications in ANSI/TIA/EIA-568-B.2-1
4. 100% factory tested to meet category 6A performance
5. ETL or any other nationally recognized 3rd party verification
6. Be center tuned to category 6A performance specifications by using paired bi-level contact array.
7. Be capable of universal T568A or T568B wiring schemes.
8. Modular connector shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
9. Have a performance marking indelibly labeled on the jacket (by the manufacturer).
10. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606-A labeling specifications.
11. Have “snagless” protection for the locking tab to prevent snagging and to protect locking tab in tight locations and provide bend relief.
12. Be available in three standard colors.
13. Be available in 3 foot, 5 foot, 7 foot, 9 foot, and 15 foot standard lengths.
14. Be backwards compatible to Category 3, 5, 5e, and 6.
15. Be manufactured by an ISO 9001 registered company
16. Be compatible for use with A/V system as submitted and approved
17. When installed below-grade, shall be OSP listed

D. Optical Fiber patch cords shall:
1. Contain two (2) single mode optical fibers.
2. Use graded-index fibers with a 9 micron core.

3. Be capable of transmission at 1310 nm and 1550 nm for single-mode.
4. Include listing of actual loss of patchcord when packaged.
5. Be manufactured in standard lengths of 1 m (3.27 ft), 2 m (6.56 ft), 3 m (9.84 ft), 4 m (13.11 ft), 7 m (22.95 ft), and 10 m (32.79 ft), and special ordered in any other lengths.
6. Be manufactured by an ISO 9001 registered company.

2.11 GROUNDING AND BONDING

A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.

B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, ungrounded conduits, etc. entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

D. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

2.12 FIRESTOP

A. A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestop system, stamped/embossed by the

PE shall be provided to the Owner’s Technical Representative prior to installing the firestop system(s).

PART 3 - EXECUTION

3.1 WORK AREA OUTLETS

A. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer’s bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12” of UTP and 12” of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.0 document, manufacturer's recommendations and best industry practices.

C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).

D. Bend radius of the horizontal cable shall not be less than 4 times the outside diameter of the UTP cable.

E. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.

F. Voice/Data jacks, also known as telecommunications jacks, for the purposes of this building are to be installed as all data, in conformance with all Category 6A standards for component and channel ratings. Data jacks, unless otherwise noted in drawings, shall be located in the top position(s) of each faceplate, populated from left-to-right and top-to-bottom in the faceplate.

G. Where (4) or fewer data jacks are specified, contractor shall install a 4-port faceplace with blank covers (with color to match faceplate) in unused modular jack openings.

3.2 HORIZONTAL DISTRIBUTION CABLE INSTALLATION

A. Cable shall be installed in accordance with manufacturer’s recommendations and best industry practices.

B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C standard, manufacturer's recommendations and best industry practices.

C. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

D. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-A maximum fill for the particular raceway type or 40%.

E. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

F. Where transition points, or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.

G. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.

H. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.

I. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

J. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

K. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.

L. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

M. Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.

N. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.

O. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.

P. Cables installed underground or below slab shall be suitable for use in wet locations and outdoors in duct or conduit. If wet location cable is exposed in the building after exiting the wet area, it must transition to an appropriate category dry cable within 50 feet (15M) of exiting conduit.

Q. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

R. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

S. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

T. The cable jacket shall be maintained as close as possible (within 25mm – 1 inch) to the termination point.

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U. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.3 OPTICAL FIBER TERMINATION HARDWARE

A. Fiber slack shall be neatly coiled around fiber reels, or within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.

C. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.

D. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.

E. A maximum of 12 strands of fiber shall be spliced in each tray.

F. All spare strands shall be installed into spare splice trays.

3.4 BACKBONE CABLE INSTALLATION

A. Backbone cables shall be installed separately from horizontal distribution cables

B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

C. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits

D. Where backbone cables are installed in an air return plenum, riser rated cable shall be installed in metallic conduit.

E. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.

F. All backbone cables shall be securely fastened to the sidewall of the TR on each floor.

G. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.

H. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.

I. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

3.5 RACKS

A. Racks shall be securely attached to the concrete floor using a minimum 5/8" hardware or as required by local codes. In no case shall the racks be secured by means any less than the requirements as detailed on the Structural or Electrical drawings.

B. Racks shall be placed with a minimum of 36-inch clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at each end of the row.

C. All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 3.9 of this document.

D. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

E. Wall mounted termination block fields shall be mounted on 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with two coats of white fire retardant paint.

F. Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.

3.6 FIRESTOP SYSTEM

A. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.7 GROUNDING SYSTEM

A. The TBB shall be designed and/or approved by a qualified PE, licensed in the state that the work is to be performed. The TBB shall adhere to the recommendations of the ANSI/TIA/EIA-607 standard, and shall be installed in accordance with best industry practice.

B. Installation and termination of the main bonding conductor to the building service entrance ground shall be performed by a licensed electrical contractor.

3.8 IDENTIFICATION AND LABELING

A. The contractor shall develop and submit for approval a labeling system for the cable installation prior to label application. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall follow the guidelines of ANSI/TIA/EIA-606-A.

B. Outside Plant cables passing through a pull box or vault shall have a cable label that is water and mud proof.

C. All label printing will be machine generated by Ortronics LabelMo, or similar software, using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

3.9 TESTING AND ACCEPTANCE

A. General
1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Certification Program Information Manual provided by the product manufacturer and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

B. Copper Link Testing
1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance.
2. Horizontal cabling shall be tested using a Level III test unit for category 6 performance compliance.
3. The basic tests required are:
   a. Wire Map
   b. Length
   c. Attenuation
   d. NEXT (Near end crosstalk)
   e. Return Loss
   f. ELFEXT Loss
   g. Propagation Delay
   h. Delay skew
   i. PSNEXT (Power sum near-end crosstalk loss)
   j. PSELFEXT (Power sum equal level far-end crosstalk loss)
4. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

5. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-C Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
6. Category 6A performance shall meet the link requirements outlined below for a 90-meter, 4-connector permanent link.

Frequency (MHz)	Maximum Insertion Loss (dB)	Minimum NEXT (dB)	Minimum PSNEXT (dB)	Minimum ELFEXT (dB)	Minimum PSELFEXT (dB)	Minimum Return Loss (dB)
1.0	2.1	74.3	72.3	-	-	20.0
4.0	3.8	65.3	63.3	-	-	23.0
10.0	5.9	59.3	57.3	-	-	25.0
16.0	7.5	56.2	54.2	-	-	25.0
20.0	8.4	54.8	52.8	-	-	25.0
31.25	10.5	51.9	49.0	-	-	23.6
62.5	15.0	47.4	45.4	-	-	21.5
100.0	19.1	44.3	42.3	-	-	20.1
250.0	31.1	38.3	36.3	-	-	17.3
350.0	37.2	36.1	34.1	-	-	16.3
400.0	40.1	35.3	33.3	-	-	15.9
500.0	45.3	33.8	31.8	-	-	15.2

NOTE: For ELFEXT and PSELFEXT, follow TIA guidelines for Cat6A

C. Fiber Testing
1. All fiber testing shall be performed on all fibers in the completed end-to-end system. Testing shall consist of an end-to-end power meter test performed per EIA/TIA-455-53A. The system loss measurements shall be provided at 850 and/or 1300 nanometers for multimode fibers and 1310 and/or 1550 nanometers for single mode fibers. These tests also include continuity checking of each fiber.
2. Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for singlemode) in both directions.
3. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B.
4. Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. ONLY LINK TEST IS REQUIRED. The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.
5. Attenuation testing shall be performed with an approved hand held tester from an industry recognized test equipment manufacturer.

3.10 SYSTEM DOCUMENTATION

A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer for approval. Documentation shall include the items detailed in the sub-sections below.

B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.

C. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.11 TEST RESULTS

A. Test documentation shall be provided on disk within three weeks after the completion of the project. The disk shall be clearly marked on the outside front cover with the words “Project Test Documentation”, the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

B. The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-C including applicable TSB’s and amendments. The appropriate Level III tester shall be used to verify Category 6A cabling systems.

C. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The telecommunications contractor must furnish this information in electronic form CD-ROM). If needed, provide manufacturers software require to read the test results.

D. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

PART 4 - WARRANTY AND SERVICES

4.1 WARRANTY

A. The manufacturer shall provide the warranty directly to the end-user.

B. An Extended Product Warranty shall be provided which warrants functionality of all components used in the system for a minimum of 20 years from the date of registration. The Extended Product Warranty shall warrant the installed horizontal and/or backbone copper, and both the horizontal and the backbone optical fiber portions of the cabling system as applicable for the cabling manufacturer.

C. The Application Assurance Warranty shall cover the failure of the wiring system to support the applications that are designed for the link/channel specifications of ANSI/TIA/EIA–568-C.0. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, 155Mb/sATM, and 1Gb/s ATM.

D. The contractor shall provide a warranty on the physical installation.

4.2 FINAL ACCEPTANCE AND SYSTEM CERTIFICATION

A. Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the cabling system for a two-week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, the end user shall be provided with a numbered certificate, from the product manufacturer, registering the installation.

END OF SECTION

SECTION 28 13 00 - ELECTRONIC ACCESS CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. The work consists of providing and installing prescribed systems and equipment, in accordance with the Owner's directives and needs. The Contractor shall design, install, and configure systems to provide the exact function described herein and will be held to the operational criteria. Contractor shall be responsible for providing and installing a complete and fully operational system, with the intended features and capabilities, whether or not all required parts, components, systems or accessories are specified in the construction documents. Contractor shall provide all required parts, components, systems, materials and accessories needed for a complete and working system, without additional cost to the owner.

B. Furnish all labor, materials, tools, equipment, and services for all Access Control Equipment, as indicated, in accord with provisions of Contract Documents. Final terminations and system commissioning to be performed by a factory certified technician. Systems and the respective specification sections which are part of this section include but are not limited to the following:
   1. Reader Controller
   2. Reader Interface
   3. Power Supply
   4. Card Readers / Keypads
   5. Wiring, switches and ancillary equipment

C. Although such work is not specifically indicated, provide and install supplementary or miscellaneous items, appurtenances and devices incidental to, or necessary for, a sound, secure and complete installation.

D. Training on operation and software of the access control system per Section 3.2 of this specification section.

1.2 INTENT OF ACCESS CONTROL SPECIFICATION

A. The following specification shall be considered as coordinated with the general conditions, special conditions and the preamble of this and other related sections. It shall be the Security Contractor's responsibility to furnish all necessary systems and equipment, in accordance with the Owner's directives and needs.

B. Where items aren't definitely or correctly specified and are required for completion of the work, a written statement of such omission, error, or other discrepancy shall be sent to the Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

C. Adjustments to the Contract Sum will not be allowed for omissions not clarified prior to bid opening.

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
   1. Furnish security equipment to comply with the requirements of laws, codes, ordinances, and regulations of the governmental authorities having jurisdiction where such requirements exceed the requirements of the Specifications.
   2. Furnish security equipment to comply with the requirements of American National Standards for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People (ICC/ANSI A117.1), the governmental authority having jurisdiction and to comply with Americans with Disabilities Act.
   3. System supplier must be certified by owner-approved system manufacturer for installing, supporting and servicing the products to be furnished. Certification shall be submitted on the equipment manufacturer's letterhead, at product submittal timeframe.

B. Contractor qualifications:
   1. Company that is trained, authorized, and certified to install the specified products.
   2. Company with a minimum of 5 (five) years system design, engineering supervision, and installation experience in the access control industry.
   3. The contractor will maintain a fully staffed local office within 150 miles of the work site. The service center will be staffed by factory trained technicians and must be adequately equipped to provide emergency phone service within twenty four (24) hours on a twenty-four (24) hour, 365 days per year basis, whether or not the owner purchases a maintenance contract with the contractor.
   4. Within the local service center, the contractor must maintain an inventory of spare parts and other items critical to system operation and as necessary to meet the emergency service requirements.
   5. The contractor must have in-house engineering and project management capability consistent with the requirements of this project. The contractor shall provide a project manager who is actively in the project. This person shall be the same individual throughout the course of the project and shall be the person responsible for the scheduling of the system programming, preparation of the Operation and Maintenance Manuals, Training Programs, documentation and system testing, maintenance of Drawings and the coordination of all subcontract labor. The owner reserves the right to approve the contractor's Project Manager.
   6. The contractor must abide by and adhere to all Drug Free School Zone laws and participate in a drug-free workplace program.

C. Testing Agency: Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Pre-Installation Conference: Prior to installation arrange conference between supplier, and related trades to review materials, procedures, and coordinating related work. Coordinate all access control device installation with door hardware specifications prior to rough-in.

E. Sequencing: The work shall be performed in the following sequence, unless directed otherwise by owner's representative:
   1. Installation of all conduit and rough-in boxes
   2. Installation of wiring
   3. Installation of Access Controllers, Modules & Power Supplies
   4. Installation of field devices and readers/network locks

5. Connection to site control & front end equipment.
6. Commissioning of the new system components.
7. End User training

F. The Authorized Dealer will provide pricing for 1 year warranty from date of purchase.

1.4 PROJECT SUMMARY

A. These specifications describe the requirements, performance parameters, and operating considerations for the installation of electronic access control systems.

B. The intent of this project will be to secure perimeter access doors/points using the access control readers and software by owner-approved system manufacturer.

1.5 WARRANTY

A. All work and system components shall be covered by a one (1) year ‘in field’ warranty against defects in materials and workmanship, commencing with substantial completion of the project, unless otherwise directed by owner or their representative.

B. During system warranty period, system updates are to be made available to owner at no charge to owner.

C. During warranty period, provide twenty-four (24) hour toll-free technical support.

1.6 SUBMITTALS

A. Under the provisions of this request for proposal, prior to the start of work the contractor shall:
1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
2. Submit proof from manufacturer of contractor’s good standing in manufacturer’s program.
3. Submit appropriate cut sheets and samples for all products, hardware and cabling.
4. Shop drawing of equipment connections, point-to-point diagrams, etc. sufficient to describe the operation of the system. Telecommunications Contractor shall include equipment listed by other trades and shall provide at submittal time.

B. Work shall not proceed without the Owner's approval of the submitted items.

C. The telecommunications contractor shall receive approval from the Owners on all substitutions of material. No substituted materials shall be installed except by written approval from the Owner.

D. If a submittal is provided without shop drawings, an immediate “Revise and Re-submit” shall be issued back to Contractor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Access Control System Hardware/Firmware/Software:
   1. Security Management System (SMS) as manufactured by owner-approved system manufacturer. (No substitutions)

2.2 SYSTEM PROGRAMMING

A. The contractor shall furnish and install all hardware, software, devices and components to meet the performance and functional requirements described in these contract documents. Include all items required, whether or not individually specified, to ensure a completely operational integrated Security Protection system. The contractor must complete all database entry (unless directed otherwise by owner or their representative), and provide the owner with training on cardholder entry, as well as all system programming. No additional costs shall be allowed to make the system operational or to meet specifications.

2.3 SYSTEM ARCHITECTURE

A. System Description:
   1. Primary function is to regulate access through specific portals to Secured areas.
   2. Utilize card technology as its primary access device.
   3. Surge Protection Components must be protected from voltage surges originating externally to equipment housing and entering through power, communication, signal, control, or sensing leads. Must also include surge protection for external wiring of each conductor-entry connection to components.
   4. Power: Any special power treatment required, such as filtering or spike elimination that may be required for proper operation and protection of the ACS, shall be provided with the system. Step down power supply with battery backup of at least 4 hours.

2.4 SYSTEM HARDWARE

A. Access Control System Hardware/Firmware/Software:
   1. As manufactured by owner-approved system manufacturer. No substitutions per District standard

B. Credentials & Readers:
   1. Owner-approved system manufacturer, No substitutions
      a. Mullion and Switchmount parts shall be acceptable based upon specific mounting conditions of device at door/access location.

C. Door Position Switches/Contacts:
   1. Refer to Door Hardware specifications (No substitutions)

D. Request-to-Exit Motion Sensors:
   1. Owner-approved system manufacturer or approved compatible equal

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E. Power Supplies:
   1. Owner-approved system manufacturer.

PART 3 - EXECUTION

3.1 SYSTEM PROGRAMMING

A. The Contractor shall work with the owner to ensure that the new components will be properly programmed into the new and/or existing system.

B. Coordination required is as follows, unless directed otherwise by owner or their representative;
   1. Personal/staff information.
   2. Access time for all personal /staff.
   3. Definitions of openings for staff access.
   4. Holiday definition
   5. Special access privileges
   6. Lock down conditions

3.2 SYSTEM INSTALLATION

A. System shall tie into existing campus access control head-end unit/system. EC shall work with owner to identify and extend existing campus access control system and appropriately tie new and existing together. EC shall provide and install all applicable components, including but not limited to, cables, patch panels, connectors, conduit, etc. for a fully functioning system.

B. EC shall provide a minimum of 250 wireless access keycard/fob to District at completion of project. Keycards/fobs shall be compatible with owner-approved system manufacturer, and shall be coordinated such that new keycards/fobs do not re-use or otherwise overlap with existing credential numbering system (credentials shall be unique).

3.3 OWNER PERSONNEL TRAINING

A. On Site Operator training: instruct operating staff in proper operation, including hands-on training.

B. Minimum of four (4), man-hours covering the operations for each system installed.

C. Training sessions shall be provided to supervisors, staff utilizing systems and equipment provided under this section, maintenance personnel and any other personnel designated by the owner. Security Contractor should prepare to provide operator training for up to ten (10) personnel.

D. Security contractor shall be prepared to provide training sessions on all work shifts, including day, evening and night shifts.

E. On Site Administrator training: instruct owner-designated security system administrators for each system installed.

F. Minimum of four (4), man-hours of training for each owner-designated individual.

G. Training to cover all administrative and management functions, features and controls for each system.

H. Refresher training: provide a 90-day refresher training session to operators and administrators.

I. Minimum of four (4) hours of training for each owner-designated Operator and/or Administrator.

J. Training shall cover summaries of all operator and administrator training topics and shall include greater detail on subject areas or operations not yet mastered by operators or administrators.

K. Review in detail all information in the operations and maintenance manuals for each system provided.

L. Prior to administering the above training, the contractor(s) shall prepare an outline of the training, identifying the goals and expectations of the course and detailing what students are expected to learn.

M. Training courses shall be videotaped for subsequent training use by the Owner.

END OF SECTION

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SECTION 28 31 00 - FIRE ALARM AND DETECTION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
1. Provide a complete, fully addressable, power limited, fire detection and evacuation system. The system shall be connected, tested, verified by AHJ to be acceptable and left in first class operating condition. All equipment herein specified shall be engineer-approved and California State Fire Marshal (CSFM) listed. The entire installation shall conform to the National Fire Protection Association (NFPA) Standard 72, 90A & CEC Article 760 and authorities having jurisdiction as applicable. The system specified and depicted on the plan is a complete and approved system. Substitution of system components or manufacturer will require the contractor to separately obtain approval with the CSFM at Contractor's expense and shall meet all requirements of the system as designed and pre-approved. The entire fire alarm system has been submitted and approved by the Division of the State Architect as a complete submittal. Any routing of the system wiring that is significantly different than shown on the approved drawings shall have the approval of the engineer and must be obtained prior to construction.
2. Provide all work and material as shown and / or required to provide a fully functional and adequate system as described hereon and as required by the California State Fire Marshal.
3. Supervision: The fire alarm system shall monitor the integrity of all alarm initiating and indicating appliance circuits and provide local and remote status of all connected systems. The system shall be provided with automatically charged standby batteries to maintain system operation for 24 HRS in the normal supervisory mode and 5 minutes of alarm. Batteries shall be supervised for connection to the system and low voltage threshold. The automatic battery charger shall be capable of charging fully discharged system batteries to 100% in 8 hours.
4. The system wiring and installation shall be as stated in drawings and as required by the manufacturer. All wiring shall be color coded, tagged and verified to assure that it is free from shorts and grounds and shall be rated for the appropriate environmental conditions such as well locations.
5. Testing: The completed system shall be tested in accordance with NFPA Standard 72-7-1.
6. Warranty: The equipment and wiring shall be warranted to be free from electrical and mechanical defects for a period of two (2) years commencing with final acceptance by Owner.
7. All Fire Alarm wiring shown in drawings shall be installed in conduit.
8. System Operation shall include:
    a. Separate zone signaling and device status indication for all initiating devices.
    b. Audible to sound the California uniform fire alarm signal in temporal mode. Devices shall be at least 15dBA above average ambient sound level or 5dBA

above the maximum sound level having a duration of not less than 60 seconds, whichever is greater, in every occupiable space within the building. The maximum sound pressure level for audible alarm notification devices shall be 110dBA at the minimum hearing distance from the audible appliance. Where the average ambient noise is greater than 95dBA, visual alarm notification shall be provided in accordance with NFPA 72 and the audible alarm notification appliances shall not be required.

c. Visual devices shall not exceed 2 flashes per second and shall not be slower than 1 flash per second. Visual devices shall be synchronized when 3 or more devices are within the same field of view.
d. Supervision of all circuits to indicate any abnormal wiring condition.
e. One (1) N.O./N.C. integral relay for external device interface or as indicated on drawings.
f. Central station connection capable of indicating (3) distinct separate signals as being tamper, trouble and alarm with point reporting capabilities.

9. All work shall be completed as shown on the plans and or as specified within this specification and shall include the following (but is not limited to):
   a. Life safety fire alarm detection and signaling system.
   b. Furnishing and installation of equipment and devices.
   c. Conductors, connections and interconnections where specified and all in conduit system.
   d. Interface with elevator controls.
   e. Conduit, wire and connections for control of heating and ventilation motors, smoke dampers and smoke exhaust.
   f. Testing, cleaning and adjusting of completed work.
   g. Wiring diagrams, as-built drawings and three (3) sets of equipment operations and maintenance instructions for Owner.
   h. Complete maintenance for two years. Proposal for subsequent maintenance contract.
   i. All work and material for complete and operable systems as indicated or specified.
   j. Permits, inspections and fees.
   k. Identification and instruction to Owner Representative. Training shall consist of a minimum or two (2) 6-hour sessions.
10. Coordination with Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
11. Furnishing of special back boxes where required for installation of fire alarm devices.
12. Mechanical system duct detectors shall interface with fire alarm system without additional or special control devices.
13. All conductors to be installed in conduit pursuant to Specification Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
14. Qualifications: Contractor shall receive written approval and verified test results which shall be submitted to the owner for system from manufacturers recognized representative prior to completion and acceptance.
15. All initiating devices shall be separately addressed for individual identification at control panel.
16. As-Built Drawings: A complete set of reproducible “as-built” drawings showing installed wiring, color coding, wire tag notations exact locations of all installed equipment, specific interconnections between all equipment and internal wiring of the equipment shall be delivered to the owner upon completion of the system.

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17. Maintenance Instructions: Three (3) submittals of maintenance instructions shall be provided and shall be complete, easy to read, understandable and shall provide the following information:
    a. Instructions for replacing any components of the system, including internal parts.
    b. Instructions for periodic cleaning and adjustments of equipment with a schedule of these functions.
    c. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.
    d. User operating instructions shall be prominently displayed on a separate sheet located next to the control unit in accordance with UL Standard 864. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for two years from the date of final acceptance.

1.3 SUBMITTALS

A. Comply with applicable provisions of Section 26 05 00, 1.4 COMMON WORK RESULTS FOR ELECTRICAL.

B. The submittal shall include certification from the manufacturer verifying that the distributor is an authorized agent, who is qualified and trained by the manufacturer in the proper installation, operation and service of the system.

C. Shop Drawings:
1. A complete list of all supplied equipment including model numbers with catalog data sheets on each component and CSFM number.
2. Provide schematic layout, floor plan, drawings indicating location of all components and equipment, required size and location of conduit and outlets and type and quantity of system conductors. Include voltage drop calculations and battery calculations based on actual number of devices to be installed. Note: It shall be acceptable to provide written acknowledgement that the engineer-prepared approved fire alarm drawings will be used as project fire alarm shop drawings and no exceptions are taken.
3. Include wiring diagrams for overall system and components including control panels, annunciators, power supplies, initiating circuits, notification appliances, control devices and FATC. Address numbers shall be noted on all appliances.
4. Include physical and electrical characteristics of equipment to indicate conformance with the Specifications.
5. Describe system characteristics and function as well as device wiring diagrams.
6. Voltage drop and battery calculations for each control panel and power supply and initiating circuits.
7. System operational matrix.

D. Data Sheets: Show California State Fire Marshal Listing, U.L. listing, equipment ratings, dimensions and finishes.

E. Manufacturer's Certificate: Note whether the system meets or exceeds specified requirements.

F. Operating and Maintenance Instruction Manual:
1. Manual shall include the following tailored to this specific project:
    a. Operational description.

b. Coded cabling plan.
c. Two wire circuit diagrams.
d. Wiring destination schedule.
e. Schematic component diagrams and PC board layouts.
f. Maintenance and alignment procedures.
g. Voltage drop and battery calculations.

1.4 COORDINATION

A. Refer to the electrical and mechanical drawings and specifications to determine quantities and location of devices and required scope of work and coordinate work with mechanical and electrical installers. Provide function described under mechanical section Sequence of Control, for fire and/or emergency conditions. Submit proposed interconnection to elevator supplier. Submit conduit and pathing requirements to electrical installer. For self-contained door release, coordinate with door supplier.

1.5 SYSTEM DESCRIPTION

A. General: System to be listed by Underwriters Laboratories and the California State Fire Marshal, designed to meet the functional requirements of NFPA 72A, 72B and 72D.

B. Features:
1. Fire control command center panel with graphic annunciator, printer (where specified) and alarm communicator transmitter (DACT) where specified and/or required.
2. Remote annunciator(s) as specified.
3. Alarm/trouble point transmitters.
4. Manual alarm reporting stations (addressable).
5. Ionization smoke detectors (addressable).
6. NAC extender panels.
7. Heat detectors (addressable).
8. Electromagnetic door hold open devices as required.
9. Horn and audible devices.
10. Visual alarm signal device.
11. Exterior bell.
12. Connection to sprinkler waterflow and pressure switches (addressable).
13. Sprinkler valve supervision (addressable).
14. Connection to existing Campus Main Fire Alarm System Controller, which is equipped with off-site central station annunciation via leased telephone lines.
15. Interface with the HVAC system for control of supply fans for all buildings. All required interface relays. Manual override control of motors and dampers at fire control panel.
16. Interface with fire dampers for the release of fire dampers on fire alarm initiation.
17. Control module.
18. Monitor module.
19. Sync. Module.

1.6 SYSTEM OPERATION

A. System to be the active interrogate/respond type alarm system, 24 volt DC noncoded, positive, non-interfering, successive operation, in which all devices are constantly sending status signals to the main fire control command center from remote data transmitter panels approximately every one second. A change in status to be reported twice to determine that it is a valid signal, and be automatically and permanently recorded.

B. Wiring, equipment and devices for alarm initiation, annunciation, and audible signaling to be continuously supervised for opens, shorts or grounds (trouble). Each alarm initiating device circuit to be provided with illuminated and audible annunciation of both trouble and alarm conditions. Non-illumination indicates a normal condition.

C. Any alarm or trouble condition shall sound an audible signal at the fire command center and the remote annunciator. Signal shall be silenced by a momentary contact switch which shall transfer the signal to a visual indicator. Subsequent trouble conditions shall cause the signal to resound and in turn may be silenced. Upon restoration to normal, the trouble signal silencing indicator shall extinguish automatically.

D. Activation of any automatic or manual alarm initiating device shall cause the following to occur:
   1. Sound an audible alarm and illuminate the visual indicator for zone and type of alarm at the fire command center, the remote annunciator and fire alarm control panel.
   2. Sound, at building of origin, the audible alarm signal over the system audible devices and activate the visual signal devices.
   3. Transmit signal to release the electromagnetic hold open devices on corridor doors by floor.
   4. Transmit signal to close smoke dampers.
   5. Transmit alarm signal to energy management system for shutdown of building air handler.
   6. Transmit alarm signal to the central station office.
   7. Release exit door locks.

E. System shall not incorporate a time delay for any of the alarm initiating devices. All alarms shall be considered confirmed alarms.

F. Detection shall be addressable and reporting of fire conditions to be accomplished by the following basic methods:
   1. Manual stations.
   2. Smoke detectors.
   3. Heat detectors.
   4. Waterflow switches.

G. Fire alarm system inputs to be further subdivided as follows, for a more defined indication of the location and nature of the fire or trouble condition:
   1. Manual station by device and location.
   2. Smoke/heat detector by device and location.
   3. Waterflow or pressure switch by device and location.
   4. Sprinkler valve position indication by device and location.

H. Alarm condition shall override trouble indication. Trouble indication shall reappear after alarm reset.

I. Fire Alarm Zones shall be as indicated on drawings.

J. Printout on system printer of all alarm and trouble reports, indicating type of device, condition, time and date and alarm clearing.

K. Selective manual testing of any device point or zone in the system to determine normal, trouble or alarm status.

L. Command center shall have annunciator indicating building floor, room number and zone.

M. Remote annunciators to duplicate annunciation from the main fire control command center.

N. System shall be capable of manual operation in the event of malfunction of the central processor. Supplier shall include a statement in the system shop drawing submittal explaining the manual operating capability of the system. System shall provide redundant processor capabilities to duplicate primary processor function.

O. HVAC Interface: Coordinate system function with mechanical contractor for programmable shutdown of building air handlers.

P. Operation: All components shall be interconnected in accordance with the manufacturer's instructions to provide a complete and operable system as described.

1.7 LOADS OF EQUIPMENT AND COMPONENTS

A. Follow IEEE Standard where applicable.

B. Provide fuse protection for equipment and spare fuses.

C. Design systems for operation at 120 volts, normal or emergency power as indicated, 60 Hz nominal input.

D. Operating voltage dissipated by resistors shall not exceed 25% of ratings.

E. Operating voltage of capacitors shall not exceed 80% of rated voltage.

F. Operating loads and voltages on transistors and solid-state devices shall not exceed manufacturer's recommendation for normal full load operation.

G. Use electronic components of types and rating commonly available from stock of established commercial distribution.

1.8 GUARANTEE

A. Conform to applicable provisions of the GENERAL REQUIREMENTS.

B. Service technicians and replacement components for the system shall be available locally from a service representative of the manufacturer who is able to provide evidence of technical training and authorization by the manufacturer.

C. For a period of two years from date of final acceptance, the system shall be under full guarantee for materials and labor at no cost to the Owner. The system shall be under a service contract with a technician authorized by the manufacturer. Replacement parts and labor shall be readily available during normal business hours while the service contract is in effect. A complete system inspection and test shall be performed at five months and again at eleven months after final acceptance. Tests shall include all smoke detector sensitivity settings.

D. All component failures shall be remedied to the satisfaction of the Owner.

E. A continuing service contract shall be offered at time of bid to commence at the expiration of warranty included with the system.

PART 2 - PRODUCT

2.1 MATERIALS

Fire Alarm Control Panel (FACP) and system shall be UL listed for power-limited application, (as described on the plans). System shall be as manufactured by Siemens: Model DESIGO FC2050, or approved alternate.

A. Peripheral Devices
   1. Analog Photoelectric Smoke Sensors (refer to drawings for model number).
      a. Analog photoelectric sensors shall have a low profile and be capable of being set at five sensitivity settings of “LOW, LOW MEDIUM, MEDIUM, MEDIUM HIGH, and HIGH” levels.
      b. Automatic and manual functional sensitivity and performance tests shall be possible without the need for generating smoke. This method shall test all sensor circuitry and a “Failed Test” indication shall display for any failed test.
      c. Two LEDs providing 360-degree visibility of operating status and alarm indication shall be provided on each sensor. The LEDs shall pulse periodically indicating that the sensor is receiving power and communication is taking place. This feature shall be field programmable. Upon alarm, these LEDs shall light continuously. An alarm output shall be available for remote annunciation.
      d. The system shall check the sensitivity of each sensor periodically. If a sensor alarm threshold sensitivity has changed, due to again and/or dust accumulation, the system shall automatically compensate for this change (drift compensation).
      e. Each sensor shall allow for the setting of two sensitivity levels. These levels may be programmed so that when the building is occupied, a sensor will be less sensitive than when the building is unoccupied. This feature permits sensors to be more reliable and at the same time reduces/minimizes unwanted alarms. This feature shall also provide for programmable weekend days, where the sensor will remain at an unoccupied sensitivity level.
      f. The sensor screen and cover assembly shall be removable for field cleaning.
   2. Addressable Thermal Sensor (refer to drawings for model number):
      a. Addressable thermal sensors shall have a low-profile and operate on the combination “rate-of-rise” and “fixed temperature” principals with the fixed

temperature set point at 135ºF. They shall contain dual thermistor sensing circuitry for fast response.

3. Addressable Subloop Monitor Module (refer to drawings for model number):
   a. An addressable monitor module with an initiating circuit capable of being configured Class B, Style B. The module shall contain a yellow status LED that shall flash when in a quiescent mode and light continuously when in alarm. The LED shall be field programmable not to provide quiescent status indication, if so desired.
4. Manual Fire Alarm Station: Double Action Manual Station (refer to drawings for model number):
   a. Furnish and install a manual station as indicated. Each station shall be of the addressable double action type, requiring an outer door to be lifted to expose the actuator door. Upon pulling forward of the actuator door, the unit shall lock into a readily observable “alarm” position.
5. Remote Serial Annunciator or approved equal:
   a. Furnish an install where shown on the plans a remote serial annunciator. The annunciator shall provide an 80-character display, which shall duplicate all information on the basic system display with the exception of menus. It shall also contain the following function keys: Alarm Acknowledge, Trouble Acknowledge, Signal Silence, System Reset/Lamp Test and System Drill Test. The cabinet shall contain a keylock, which will enable the switches only when placed in the “ON” position, with the exception of the Trouble Acknowledge, which is used to silence the local trouble audible sounder. The annunciator shall also contain the following LEDs: Alarm, Supervisory, System Trouble, Power Fault, System Silenced, NAC #1 Silenced, NAC #2 Silenced. The annunciator shall mount on a standard three-gang surface or flush electrical box. The control panel shall accommodate up to five (5) remote annunciators, which can be located up to 4,000 feet from the control panel.
6. Electromagnetic Door Holders:
   a. Electromagnetic door holders shall be provided to hold fire and smoke barrier doors open until released by an alarm. The holders shall have approximately 35 lb. (15.9 kg) holding power and offer fail safe operation. The holders shall be capable of operation on 12 VDC, 24 VAC, 24 VDC, of 120 VAC without need of any configuration. Furnish and install where shown on plans. All holders shall be released via the control panel after an alarm has been initiated from any zone. All circuits shall be separately fused.

B. Fire Alarm remote power supply, NAC panel, shall be UL listed for power-limited application. Provided with (4) four-signal circuits minimum capacity or as required to make system fully operational with an output current of 6 to 9 amps as required for proper operation.

C. System Devices and components shall be provided as specified on the fire alarm equipment legend and as shown on associated electrical drawing:

D. Fire Alarm terminal cabinet shall be Square D Class 6650. Size as shown on drawings or as required.

E. Substitutions
   1. The fire alarm System has been designed and approved as a “complete system”. Substitute equipment will be approved when the following conditions are met:

a. A request for substitution shall be made prior to bid for the Owner’s and design team consideration and approval.
b. Submit detailed fire alarm plans, specifications and engineering calculations including but not necessarily limited to:
1) CSFM listing #’s and Manufacturer Model #’s for every system component which is to be interconnected as a part of this project.
2) Single line, riser and point to point wiring diagrams including battery and voltage drop calculations for the entire system in compliance with NFPA 72. Indicating appliance shall be calculated on the bases of the highest current rating possible at that device.
3) Indication of conductor type(s), power-limited or non-power-limited system, independent of interconnected to existing system.

2. Submit / obtain approval from the Owner, Engineer and DSA for the entire system.
a. The party requesting the substitution shall be responsible for any additional cost acquired during the approval.
3. Approval of a request for substitution will be contingent upon acceptance and approval of DSA.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with all applicable paragraphs in Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL, apply as though repeated herein.

B. Install system(s) in accordance with manufacturer's instructions.

C. Include services of certified technicians to supervise installation, provide adjustments, provide final connections, system testing and system training to Owner Representative.

3.2 GROUNDING

A. All equipment to be grounded by means of green ground wire to "U" contact of duplex receptacles and bonded to ground provided under 26 05 26, GROUNDING AND BONDING OF ELECTRICAL SYSTEMS.

3.3 INSPECTION

A. Systems to meet all the requirements of the CSFM and IOR and AHJ and shall be approved thereby before installation and prior to final acceptance.

3.4 LOCATION

A. Before installation, verify exact location of control equipment and outlets. The Owner reserves the right to relocate system components within a radius of 10' at no increase in cost before rough-in work is started for the respective component.

3.5 WIRING

A. Furnish all conductors, equipment, terminal strips, etc., and labor to install a complete and operable system. All cable conductors shall be color coded and numbered for identification at all terminals. Green shall be for grounding conductor only. Use red insulation and or red jacketing on all fire alarm cable.

3.6 TESTING

A. After all equipment specified herein for each system has been installed and is in operating condition, conduct performance tests to determine if the installation and components comply with these specifications. Furnish competent personnel, all test material and approved test instruments and conduct the tests under supervision of factory personnel, in the presence of the Engineer, the building and fire inspecting agencies.
   1. The contractor's job foreman, in the presence of a representative of the manufacturer, a representative of the owner, and the fire department shall operate every installed device to verify proper operation and correct annunciation at the control panel.
   2. At least on half of all tests shall be performed on battery standby power.
   3. Where application of heat would destroy any detector, it may be manually activated.
   4. The signaling line circuits and notification appliance circuits shall be opened in at least two (2) locations to verify the presence of supervision.
   5. When the testing has been completed to the satisfaction of the contractor representative IOR, representatives of the manufacturer and owner, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to the owner and the authority having jurisdiction.
   6. The contractor shall leave the fire alarm system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within two years from the date of final acceptance by the awarding authority.
   7. The local responding fire department must be notified prior to the final test in accordance with local requirements and when requested, participate in system testing and evaluation.

3.7 REPORT

A. Prepare written report of final test results, signed by witnessing parties. Submit to the Engineer in triplicate for final approval.

END OF SECTION

SECTION 31 11 00 – CLEARING AND DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:
   1. Section includes requirements governing execution of the work including, but not limited to, the following:
      a. Demolition and removal of small building(s) or structure(s).
      b. Demolition and removal of above and below ground site improvements.
      c. Removal of Contaminated Soils.
      d. Removal of trees and shrubs.
      e. Clearing and grubbing.
      f. Stripping and stockpiling.

B. Related Sections: The following Project Manuel Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS
   2. DIVISION 01 SPECIFICATION SECTIONS
   3. 02 01 10 EXISTING LANDSCAPE MAINTENANCE
   4. 02 26 00 HAZARDOUS MATERIALS PROCEDURES
   5. 02 41 19 SELECTIVE DEMOLITION
   6. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP
   7. SPECIFICATION SECTIONS IN THE SITE AND SUBSTRUCTURE SUBGROUP

1.2 DEFINITIONS

A. Existing to Remain: Existing item(s) within project site that is not to be permanently removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. Remove: Detach item(s) and legally dispose or recycle off-site.

C. Remove and Reinstall: Detach item(s) from existing site or building and prepare for reuse. Reinstall where indicated.

D. Remove and Salvage: Carefully detach items(s) from existing site or building, in a manner to prevent damage, and deliver to Owner.

E. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms

F. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

G. Vegetation: Native trees, shrubs, grass, and other plants indigenous to the site.

1.3 SUBMITTALS

A. Submit in accordance with specification section – SUBMITTAL PROCEDURES:

1. Shop Drawings:
    a. Proposed Protection Measures – Submit report and drawings that indicate the measures proposed for protecting property for dust and noise control.
        1) Indicate proposed locations and construction of barriers.
        2) Indicate how long utility services will be interrupted.
    b. Salvaged Item Inventory List
        1) Indicate items to be salvaged and delivered to Owner.
2. Closeout Submittals:
    a. Pre-demolition Photographs

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
1. In accordance with specification section – REGULATORY REQUIREMENTS and the following:
    a. CAL/OSHA California Division of Occupational Safety and Health Administration
    b. EPA Environmental Protection Agency

B. Meetings:
1. Pre- Demolition and Clearing: Schedule prior to the start of work.
    a. Coordinate the work with other work being performed.
    b. Review requirements of work performed by others that rely on soil and/or substrates exposed by clearing and demolition work.
    c. Identify any potential problems, which may impede planned progress and proper clearing and demolition work.
    d. Review areas where existing item(s) are to remain and requires protection.
    e. Review demolition waste disposal and material recycling procedures.
2. Progress: Scheduled by the Contractor during the performance of the work.
    a. Review for proper work progress.
    b. Identify any problems and acceptable corrective measures.
    c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
    a. Inspect and identify any problems.
    b. Establish method and procedures to maintain protections while progressing to project completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Cleaning, handling, and packing:
1. Salvaged Items and Reinstalled Items shall be handled in such a manner as to assure that they are free from damage.
2. Salvaged Items shall be cleaned and packed or cleaned and palleted.
3. Reinstalled Items shall be cleaned.

B. Storage and protection
1. Salvaged Items and Reinstalled Items shall be stored in a dry, protected area.
2. Salvaged Items and Reinstalled Items shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation underneath.
    a. Cover with protective waterproof covering providing for adequate air circulation and ventilation.

C. Waste Management and Disposal:

1. Disposal of all demolition items shall be per Specification Section - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
2. All excavated top soil and land clearing debris shall be stockpiled on-site and reused or recycled.
    a. Grade and shape stockpiles to drain surface water.
    b. Cover stockpiles to prevent windblown dust and erosion by water.

1.6 PROJECT CONDITIONS

A. Environmental requirements;
1. Dust control: perform work in a manner as to minimize the spread of dust and flying particles.
    a. Thoroughly moisten appropriate surfaces as required to prevent dust from being a nuisance to the public and neighbors.
2. Noise control: perform work in a manner as to minimize construction noise.
    a. When a certain level of noise is unavoidable and is objectionable to the neighbors, coordinate with Owner and make arrangements to perform such work at the most appropriate time periods of the day.
3. Erosion control: do not perform site clearing operations until temporary erosion and sedimentation control measures are in place.
4. Burning: No burning will be allowed on-site.

B. Existing conditions:
1. Examine project site and building(s) and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Conduct work so as not to interfere unnecessarily with adjacent buildings, roads, streets, drives, and walks.
    a. Do not close or obstruct streets, alleys, walks, or passageways without permission from authorities having jurisdiction and coordinating same with immediate neighbors whose business operation may be affected.
    b. Provide alternate routes around closed or obstructed traffic ways if required by the authorities having jurisdiction.
    c. Safety measures shall be taken to insure an uninterrupted flow of traffic around the site as required by local Fire and Police Departments.
3. Maintain existing utilities indicated to remain in service and protect against damage during clearing and demolition work.
4. Demolition waste becomes the property of the Contractor.
5. Storage or sale of removed items on-site is not permitted.
6. It is not expected that hazardous materials will be encountered in the Work.
    a. Hazardous materials will be removed by Owner before start of the Work.
    b. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
7. Hazardous materials are present in buildings and structures to be demolished. The Owner has prepared a report for the Contractor to review and use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish all materials, tools, equipment, facilities, and services as required for performing the clearing, demolition, and removal work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions:
   1. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
   2. Execution of work under this specification section shall constitute acceptance of existing conditions.
   3. Obtain all necessary permits and authorizations by regulatory agencies required to perform the Work under this Section.
   4. Record existing conditions by use of Pre-demolition Photographs.
      a. Inventory and record the condition of items to be salvaged and/or re-installed.
   5. Examine the location of existing utilities as identified per Specification Section - FIELD ENGINEERING.

3.2 PREPARATION

A. Coordination:
   1. Before proceeding, verify plans match existing conditions.
   2. Review documents of existing construction provided by Owner against existing conditions.
   3. If conflicts are encountered, report it to the Architect. Then prepare recommendation(s) for correction and submit to Architect for review.
   4. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
      a. Coordinate with the requirements of Specification Section - EXISTING LANDSCAPE MAINTENANCE for protection of trees, shrubs, turf, and vegetation.
   5. Coordinate any utility shut-down with owner 48 hours in advance of the anticipated shut-down.
      a. Do not interrupt utilities serving adjacent existing facilities, except when authorized in writing by the Owner.
      b. Provide temporary service during interruptions to existing facilities, as may be required by the Owner to maintain essential services.
      c. Coordinate location of existing utilities with Specification Section - FIELD ENGINEERING.
   6. Prior to clearing and demolition, review status of trees and shrubs with Architect and Owner. The Owner may wish to relocate trees or shrubs to outside the limits of construction.

B. Protection:

1. Structure and Property:
    a. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings, landscape, and facilities to remain.
    b. Provide protection to ensure safe passage of people around clearing and demolition area and to and from adjacent building(s) and site.
    c. Protect and maintain benchmarks and survey control points from disturbance during clearing and demolition operations.
    d. Protect and maintain utility services to remain.
    e. Protect existing improvements designated to remain from damage during construction.
    f. All damage inflicted on public and private property and the property of the Owner shall be repaired or restored to the original condition prior to the start of this Work. All repair or replacement work shall be done at no additional cost to the owner.

3.3 APPLICATION

A. General:
1. Implement temporary erosion control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
    a. Inspect, maintain, and repair temporary erosion control measures during construction and until permanent landscape has been established or until new improvements are completed.
2. Arrange with utility companies to shut off indicated utilities.
    a. Excavate and remove underground utilities as indicated.
    b. Excavate, cap, and seal underground utilities as indicated.
    c. Utility lines to be abandoned within the construction area shall be removed and stubbed off outside the limits of construction.
3. Visually locate trees, shrubs, turf, and vegetation to remain.
    a. Salvage trees, shrubs, and vegetation to be re-installed or returned to Owner.

B. Demolition:
1. Demolition shall include the removal of all components of the existing building and/or site described in the documents to be removed. Unless otherwise specified, the component identified for removal shall include all materials, accessories and fabrications associated with that component.
    a. At pavement or concrete on grade: unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement or concrete to remain before removing adjacent material. Saw-cut faces vertically.
2. Removed and Salvaged items:
    a. Clean salvaged items.
    b. Pack or crate items after cleaning. Identify contents of containers.
    c. Store items in a secure area until delivery to Owner.
    d. Transport item to Owner's storage area [**on-site**] [**off-site**] [**list address**].
    e. Protect items from damage during transport and storage.
    f. In addition to items indicated elsewhere, salvageable items that the Owner wants to retain in usable condition is as follows:
        1) All door hardware
        2) All unit heater and controls
        3) All energy management controls
        4) All security system devices
3. Removed and Reinstalled items:
    a. Clean and repair items to functional condition adequate for intended reuse.
    b. Pack or crate items after cleaning and repairing. Identify contents of containers.
    c. Protect items from damage during transport and storage.

d. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

4. Existing Items to Remain:
   a. Protect construction indicated to remain against damage and soiling during clearing and demolition operations.
5. Remove debris, concrete, asphalt, and any other obstruction above and below-grade to the extent indicated.
6. Remove all:
   a. Buried objects which will interfere with the Work.
   b. Septic Systems.
   c. Irrigation lines, irrigation risers, and irrigation valves.
   d. Stand pipes.
   e. Water wells and pumps.
   f. Electrical service and power poles.
7. Demolished items that are recyclable or slated for disposal shall be promptly dealt with per Specification Section - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

C. Clearing and Grubbing:
1. Refer to drawings for trees and shrubs to be removed.
2. Remove tops, trunks, and roots of trees and shrubs to a minimum depth of 3 feet or to a depth required to remove all roots 1/4 inch diameter and larger.
3. Remove all sod, turf, and grass before stripping topsoil.
   a. Stockpile for recycling as mulch. Refer to Specification Section - LANDSCAPE PLANTING for treatment.
   b. Stockpile for recycling as mulch. Remove material to recycling station.
   c. Legally dispose off-site.
4. Chip removed trees, shrubs, and roots.
   a. Remove chipped material to recycling station.
   b. Recycle chipped material into mulch for this project. Refer to Specification Section - LANDSCAPE PLANTING for treatment.

D. Topsoil Stripping:
1. Strip topsoil to a minimum depth of [**12**] inches.
   a. Prevent intermingling with underlying subsoil or other waste materials.
   b. Perform only when the topsoil is dry or slightly moist.
2. Remove subsoil, and non-soil materials from topsoil, including clay lumps, gravel, trash, debris, weeds, roots, other waste materials, and objects more than 1/2 inch in diameter.
3. Stockpile reusable topsoil away from excavation and where work is to proceed without intermixing with subsoil.
   a. Do not stockpile topsoil within drip line of remaining trees.
4. Non-soil materials removed from topsoil shall be separated into like materials and recycled either within the project or removed from the project site to a recycling station.
   a. Those waste materials that are non-recyclable shall be legally disposed off of the project site.

3.4 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT:
1. Clean any soiled surfaces to remain immediately.
2. Existing substrates shall be clean and ready for the installation of any additional materials.

3. Leave site level and free of any ruts or debris. Appearance of earth surface shall be equal to or better than adjacent undisturbed surfaces.

END OF SECTION

SECTION 31 20 00– EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to do all Earthwork and other related items necessary to complete the Project as indicated by Contract Documents unless specifically excluded.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 03 11 01 CONCRETE FORMWORK
   4. 03 20 00 REINFORCEMENT
   5. 03 30 00 CAST-IN-PLACE CONCRETE
   6. 04 22 00 CONCRETE MASONRY UNITS
   7. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   8. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product Data:
      a. Information indicating the source of all import material, the fill material type and where it is to be used.
   2. Quality Assurance/Control:
      a. Material Test Reports:
         1) Classification of Soils.
         2) Compaction Characteristics of Soils.
         3) Density and Unit Weight of Soils in Place.
         4) Environmental Contaminates Report.
         5) Import Soil:
            a) Letter of certification from Owner's Testing Lab indicating material conforms to DTSC requirements.
            b) Soil Test Results.
   3. Project Closeout: In accordance with Specification Section – PROJECT CLOSEOUT.
      a. Drawings indicating the extent and depth of all engineered fill. This information shall be a part of the Project "As-Built" and Project "Record" Documents in accordance with the Specification Section – PROJECT DOCUMENTS.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Material:
      a. Soils Report: Prepared by:
         1) Technicon Engineering Services, Inc.**, (TES No. 230573.001)**.

2) The report of the existing soil conditions is available for reference only at the Geotechnical Consultant's office for purchase at the cost of reproduction.

2. Installer:
   a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this project.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS and the following:

a.	AHJ	Authority Having Jurisdiction
b.	CAL/OSHA	Comply with all provisions of the Construction Safety Orders and the General Safety Orders of the California Division of Occupational Safety and Health, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground excavations.
c.	DTSC	California Department of Toxic Substances Control.
d.	EPA	Environmental Protection Agency.

C. Certificates:
1. Installer's certification that all Earthwork installation meets or exceeds the requirements of this specification.
2. Contractor's certification (on Contractor's letterhead paper) that the Earthwork materials and installation meets or exceeds the requirements of this specification.
3. Contractor and Supplier of imported material shall provide certification from the Owner's Testing Lab to certify that the soils do not contain any environmental contaminates regulated by Local, State or Federal Agencies. Cost of testing is the responsibility of the Contractor.

D. Meetings:
1. Pre-Installation: Schedule prior to the start of work.
   a. Coordinate the work with other work being performed.
   b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
   a. Review for proper installation of work progress.
   b. Identify any installation problems and acceptable corrective measures.
   c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
   a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
   b. Maintaining installed work until the Notice of Substantial Completion has been executed.

1.4 PROJECT CONDITIONS

A. Existing Conditions:
1. Examine site and verify conditions with the Drawings and Specifications.
2. Thoroughly investigate and verify conditions under which the Work is to be performed.
3. Locate and identify utilities:
   a. Call a Local Utility Locater Service (USA - "Underground Service Alert") for the task of locating any applicable off-site and on-site utilities in the area where the Project is located.

4. No allowance for extra Work will be granted resulting from negligence or failure to meet requirements of Article titled "Existing Conditions" above.

B. Environmental Requirements:
   1. Dust control: Perform work in a manner as to minimize the spread of dust and flying particles. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other on-site work.
      a. All disturbed areas, including storage piles, which are not being actively utilized for construction purposes, shall be effectively stabilized of dust emissions using water, chemical stabilizer/suppressant, or vegetative ground cover.
      b. All on-site unpaved roads shall be effectively stabilized of dust emissions using water or chemical stabilizer/suppressant.
      c. All land clearing, grubbing, scraping, excavation, land leveling, grading, and cut and fill activities shall be effectively controlled of fugitive dust emissions utilizing application or water or by presoaking.
      d. When materials are transported off-site, all material shall be covered, effectively wetted to limit visible dust emissions or at least six inches of freeboard space from the top of the container shall be maintained.
      e. All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at least once every 24 hours when operations are occurring. The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions. The use of blower devices is expressly forbidden.
      f. Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing sufficient water or chemical stabilizer/ suppressant.
   2. Burning: No burning will be allowed on-site.
   3. Rain: Work under this section shall not be started or maintained under threat of rain, unless the work is not affected by the rain.
   4. Do not place fill during weather conditions which will alter moisture content of fill materials sufficiently to make compaction to the specified densities difficult or impossible.
   5. When reference is made to SWPPP (Storm Water Pollution Prevention Plan, if any within this Project Manual), then comply with all environmental protection requirements included therein.
   6. In accordance with EPA and AHJ.

C. Protection:
   1. Protect cut and fill areas to prevent water running into excavation. Maintain areas free of water. Remove seeping water immediately by pumps.
   2. Protect cut slopes from erosion due to precipitation and other sources of runoff.
   3. Protect utilities to remain within the construction area and special construction. If utility lines are uncovered (water, electric, sewer, etc.) not shown on the drawings during excavation of site, notify the Architect promptly for its review and action.
   4. Do not permit access to undeveloped portions of the site, nor to areas that are outside of the limits of grading.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Locator Tape:

1. Tape shall be an inert material such as polyethylene plastic with a metallic core, and highly resistant to alkalis, acids, or other chemical components likely to be encountered in soils. The tape shall be bright colors for contrast with the soils with identifying print in black letters. The tape shall be 6 inches wide and installed over all of the pipelines as shown on the drawings.

B. Earth Fill:
1. Fill shall consist of non-hazardous, non-expansive, low corrosivity and predominantly granular material composed of a reasonably well graded mixture of hard inert mineral fragments, approved by the Geotechnical Engineer.
2. Free of brush, roots, sod, rubbish or other organic materials or clay.
3. Free of rocks **3 inches** or larger in greatest dimension. Not more than **15 percent** larger than **2-1/2 inches**. Remove rock or stones, which may interfere with the action of compacting equipment.
4. Materials excavated from the site below the top **twelve (12)** inches may be used, subject to approval by the Geotechnical Engineer.
   a. On-Site materials shall be in accordance with Earth Fill paragraph within this specification section, and remove all roots **1/4 inch** in diameter or larger.
   b. The minimum moisture conditioning of the soil shall be +4% over optimum moisture content at the time of placement.
5. Imported soil shall be predominantly granular material, as described in PART 2 paragraph titled IMPORT MATERIAL.

C. Engineered Fill:
1. All Engineered Fill shall be in accordance with Earth Fill paragraph in this specification section.
2. Import Material:
   a. Import Material to be used as Engineered Fill shall have the consistency as follows:
      1) Percent Passing 3-inch Sieve **100**
      2) Percent Passing No. 4 Sieve **60-100**
      3) Percent Passing No. 200 Sieve **20-50**
      4) Plasticity Index **Less than or Equal to 9**
      5) Expansion Index **Less than 20**
      6) "R"Value (for fill placed in pavement areas only) **Minimum 5**
   b. The Contractor shall be responsible for securing an acceptable source of import material with the approval of the Geotechnical Engineer and the Owner's Testing Lab prior to transport to the site.
   c. All import material shall meet the standards and criteria of DTSC for environmentally clean soil suitable for school construction.
3. Materials excavated from the site below the top **twelve (12) inches** may be used, subject to approval by the Geotechnical Engineer:
   a. On-Site soils shall be in accordance with Engineered Fill paragraph in this specification section and remove all roots 1/4 inch in diameter or larger.

D. Back Fill:
1. Mechanical and Plumbing Utility Trench Back Fill shall be soil in accordance with "Earth Fill" paragraph within this specification section.
2. Electrical Utility Trench Back Fill shall be sand in accordance with "Sand Fill" (for Electrical Trenches) paragraph within this specification section.
3. Lean Concrete: Refer to Specification Section – CAST-IN-PLACE CONCRETE.

E. Sand Fill:
1. Sand to be washed and of natural siliceous or igneous origin, having hard, strong, and durable particles.

2. Sand shall comply with ASTM C 33 "Standard Specification for Concrete Aggregates", generally as follows:
   a. Percent passing 3/8 inch sieve: **100%**.
   b. Percent passing No. 4 sieve: **95 to 100%**.
   c. Percent passing No. 50 sieve: **10 to 30%**.
   d. Percent passing No. 100 sieve: **2 to 10%**.

F. Finish Fill:
1. Predominately granular material composed of a reasonably, well-graded mixture of hard inert mineral fragments approved by Geotechnical Engineer.
2. Shall be topsoil free of brush, roots, sod, rubbish or other organic materials.
3. Free of rocks **1/2 inch** or larger and not more than **15 percent**.
4. Topsoil stripped from the top **twelve (12)** inches from the site may be re-used subject to approval by the Geotechnical Engineer.

2.2 SOURCE QUALITY CONTROL

A. Tests, Inspection:
1. Material Test Reports: Performed by the Owner's Testing Laboratory agency in accordance with the Specification Section – TESTING LABORATORY SERVICES, indicating and interpreting test results for compliance of the following with requirements:
   a. Classification according to ASTM D 2487 "Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)," of each on-site and import soil material proposed for fill and backfill.
   b. Laboratory compaction curve according to ASTM D 1557 "Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lb./sq.ft.)," for each on-site and import soil material proposed for fill and backfill.
2. Material Test Reports: Performed by the Owner's Testing Laboratory agency in accordance with the Specification Section – TESTING LABORATORY SERVICES, indicating and interpreting test results for compliance of the following with requirements:
   a. Imported soil: Test report showing import fill dirt chemicals are within allowable DTSC standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual, which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION:

A. Layout of Work:
1. Contractor shall be responsible for all lines and grades.
2. Check all bench marks, monuments and property lines and verify locations.

3. Locate and maintain all grade stakes.
4. Monuments moved or displaced during grading operation are to be replaced by a California Registered Civil Engineer or Surveyor, at Contractor's expense.

B. Coordination:
1. Coordinate work under this specification section with work specified under other specification sections to ensure proper and adequate interface of work.
2. If this project contains a STORM WATER POLLUTION PREVENTION PLAN (SWPPP), coordinate with the requirements of that section for protection of the site and adjacent properties.

C. Protection:
1. Protect and maintain all benchmarks and survey control points from disturbance during clearing and demolition operations.
2. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
3. Protect existing improvements designated to remain from damage during construction.
   a. Restore damaged improvements to their original condition, as acceptable to the Owner.
   b. Support exiting fences as required, where site earthwork operations are near existing fence posts or footings.

D. Surface Preparation:
1. Stripping:
   a. Remove all topsoil, vegetation, organics and debris from entire project site. Remove to a minimum of stripping depth of **three (3) inches**.
   b. Stockpile stripped topsoil suitable to be re-used as Finish Fill for:
      1) Landscape areas.
      2) Athletic Field areas.
      3) Stripped topsoil is not suitable for use as Earth Fill and Engineered Fill.
2. Removal of loose or organic soils resulting from Specification Section – CLEARING AND DEMOLITION.
   a. All loose or organic materials resulting from excavations and removal of:
      1) Irrigation lines.
      2) Trees.
      3) Existing above and below grade improvements shall be removed.
   b. Expose undisturbed native soils, scarify to a minimum depth of **twelve (12)** inches, then compact as Engineered Fill.
   c. At locations where the existing ground slope exceeds a ratio of 4:1 (horizontal to vertical ratio), the existing ground surface must be "benched" as directed by the Geotechnical Engineer, prior to placing fill material.
   d. Backfill with Engineered Fill at building areas, exterior pavement areas, concrete slab areas and improvement structures.
      1) Backfill with Earth Fill at Landscape and Athletic Field areas.

3.3 CONSTRUCTION

A. Over-excavation:
1. Over-excavation shall occur after stripping operations.
2. Over-excavate at all planned building areas to a depth indicated on the drawings, but not less than **forty-eight (48)** inches below exposed grade or **twelve (12)** inches below bottom of foundation footings, whichever is greater.

3. Over-excavate to a depth indicated on the drawings, but not less than **twenty-four (24)** inches below exposed grade at:
   a. Exterior pavement (drives and parking) areas.
   b. Concrete slab (emergency access, sidewalk, and curb) areas.
   c. Improvement structures.
4. Extend over-excavation for not less than **five (5) feet** beyond the perimeter of the footprint of each:
   a. Respective building area.
   b. Exterior pavement areas.
   c. Concrete slab areas.
   d. Improvement structures.
   e. Over-excavation shall not undermine and extend beyond past existing site improvements that are to remain.
5. Stockpile excavated on-site soils suitable to be re-used as Earth Fill or Engineered Fill.
6. Remove all unsuitable excavated material.

B. Scarification and Compaction:
1. Scarification and Compaction shall occur after over-excavation operations.
2. The exposed grade in areas to receive Earth Fill and Engineered Fill shall be scarified to a minimum depth of **twelve (12) inches**.
3. Minimum moisture conditioning =4% over optimum moisture content.
4. Compact to not less than eighty-eight (88) percent and not more than **ninety-two (92)** percent of the maximum dry density in accordance with ASTM D 1557 "Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lb./sq.ft.)."

C. Placing Earth Fill:
1. Shall occur after scarification and compaction operations.
2. Spread Earth Fill in successive layers that will result in compacted layers **six (6) inches** thick maximum.
3. Moisten or dry Earth Fill to obtain optimum moisture content for compaction. Add water as required to obtain uniform distribution of water to each layer. Disc soil to thoroughly mix after water is added.
4. Compact Earth Fill to a density of not less than eighty-eight (88) percent and not more than **ninety-two (92)** percent in accordance with ASTM D 1557 "Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lb./sq.ft.)."
5. Compaction by ponding and jetting shall not be permitted.
6. Contractor shall be responsible for selection of equipment used for compaction, and for obtaining specified fill density.
7. Costs of initial compaction tests shall be borne by the Owner. Contractor shall pay for all re-tests required due to failure of initial tests.

D. Placing Engineered Fill:
1. Shall occur after scarification and compaction operations.
2. Place Engineered Fill in accordance with article titled "Placing Earth Fill" within this specification section.
3. As a minimum, extend to **five (5) feet** beyond the perimeter of the footprint of each:
   a. Respective building area.
   b. Exterior pavement areas.
   c. Concrete slab areas.
   d. Improvement structures.
4. Preparation of sub-grade and selection and placing of Engineered Fill subject to continuous inspection and supervision of Geotechnical Engineer.

5. Compact Engineered Fill to a density of not less than [eighty-eight (88) percent, but not more than **ninety-two (92)** percent, in accordance with ASTM D 1557 "Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lb./sq.ft.)." Density of each layer of Engineered Fill shall be tested and verified that it meets required density of Geotechnical Engineer prior to placing succeeding layer.
    a. Compact top **twelve (12) inches** of Engineered Fill a density of not less than **ninety-five (95)** percent in accordance with Test Designation ASTM D 1557 "Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lb./sq.ft.)" at:
        1) Dedicated fire access areas.
        2) Parking areas.
        3) Driveway areas.
        4) Playcourt areas.
6. Roll Engineered Fill under interior and exterior slabs to smooth surface, free of large or sharp particles.
7. Conduct work to minimize inspection costs.
8. When testing agency reports that sub-grades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; re-compact and retest until specified compaction is obtained.

E. Excavation for Formwork:
1. Excavate for footings to depth and width indicate on the drawings or within these specifications.
2. Protect top corners of trenches against sloughing.
3. Side forms at footings may be omitted if excavation stands without caving. Make footing trench **two (2) inches** wider than width of concrete footing indicated on the drawings, when earth is used as a form. Cut trenches true and straight. Make side cuts neat and plumb. Bottom of trenches shall be level with reasonably sharp corners.
4. When forms are required at footings, allow additional space for construction and inspection.
5. Provide means to accurately position and secure sill bolts, tie downs, reinforcing, and all other inserts in concrete.
6. Footings to bear on firm soil, as determined and approved by the Geotechnical Engineer.
7. Notify the Architect if unsuitable bearing is encountered at depths indicated. After review and approval of the Architect and Geotechnical Engineer, continue excavation.
8. Fill trenches excavated below indicated depths on drawings with concrete to required elevations. Concrete shall be in accordance with Specification Section - CAST-IN-PLACE CONCRETE.

F. Trenching for Piping or Conduit:
1. Cut trenches true and straight. Make sides with neat cut. Bottom of trenches shall be uniform and in conformance with laying piping.
2. Cut trenches wide enough to provide sufficient working space.
3. Piping or conduit to bear on firm soil. Notify the Architect if unsuitable bearing is encountered at depths indicated on the drawings.
    a. Sub-Base Support: Where installation of sub-base material is indicated, excavate to depth indicated or, if not otherwise indicated, a minimum of **six (6) inches** below bottom of work to be supported.
    b. Excavate by hand below belling so that piping bears continuously on firm soil.
4. Fill trenches excavated below required depths to required depths with Sand Fill, Earth Fill or Back Fill as required in accordance with article titled "Placing Back Fill" within this specification section.

a. Lean concrete shall be used as Back Fill where Utility Trenches extending from the exterior to the interior limits of building. Lean concrete shall extend a minimum distance of **two (2) feet** laterally on each side of the exterior building line and a minimum of **six (6) inches** above footing penetration.

G. Protection of Excavations:
1. Provide all shoring and bracing as required and those codified in local, state or federal safety regulations.
   a. OSHA Health and Safety Standards for Excavations.
   b. Any other successor regulations.
2. Prevent water, caving, or sloughing from entering excavation.
3. Maintain excavations free of water.

H. Placing Back Fill:
1. Remove all debris, wood, paper and deleterious materials from excavations before placing Back Fill.
2. Do not backfill against foundation wall without Architect's approval and not until forms have been removed. Place Back Fill on each side simultaneously or brace one side.
3. Do not Back Fill over piping until piping has been tested, inspected and approved.
4. Place Back Fill in accordance with article titled "Placing Earth Fill" within this specification section, or in accordance with article titled "Placing Engineered Fill" within this specification section, when Back Fill occurs within limits of Engineered Fill.
   a. Compact around the lower haunches of piping without disturbing the pipe's line and grade.
   b. Compact the fill to not less than eighty-eight (88) percent and not more than **ninety-two (92)** percent minimum **twelve (12) inches** above pipe or to **twenty-four (24) inches** of required grade, whichever is greater.
   c. Compact the remainder of the fill to not less than eighty-eight (88) percent and not more than **ninety-two (92)** percent minimum, or as required by surface construction.
   d. All compaction shall be in accordance with ASTM D 1557 "Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lb./sq.ft.)."
5. Jetting of trench backfill is not allowed.

I. Placing Finish Fill:
1. Remove debris subject to termite attack, rot, or corrosion and all other deleterious materials from areas to receive Finish Fill.
2. Place Finish Fill in Landscape and Athletic Field areas only. The maximum depth allowed is **twelve (12) inches**.
3. Place Finish Fill in maximum layers of **six (6) inches** and compact to a density of not less than **eighty-five (85)** percent in accordance with ASTM D 1557 "Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lb./sq.ft.)."

J. Grading:
1. Grade to elevations as indicated on the drawings.
2. Grading shall be reasonably smooth, compacted and free from irregular surface changes.
3. Grade ditches, swales and gutters to drain readily.
4. Slope grade evenly from proposed building pads in all directions to provide drainage.
   a. Grades at exterior building walls shall slope away from the structure at a minimum slope of **two (2)** percent for a minimum of **five (5) feet**, in order to prevent standing water adjacent to building foundations.
5. Protect newly graded areas. Repair impairments resulting to grading from settlement or washing and re-establish grades to the required elevations and slopes.

6. All grading shall be plus or minus **0.05 foot** of the designated grade in areas to receive concrete slabs-on-grade, other concrete improvements, and asphalt concrete paving.
    a. Finished grades in turf and planter areas shall be within plus or minus 0.05 foot of the designated grade.
7. Keep elevations of areas to be turfed **one (1) inch** below proposed adjoining walks, curbs, slabs, etc., and areas of planters **two (2) inches** below proposed improvements.
8. All grading shall be plus or minus **0.05 foot** of the designated grade in areas to receive concrete slabs-on-grade, other concrete improvements, and asphalt concrete paving.
    a. Finished grades in turf and planter areas shall be within plus or minus **0.10 foot** of the designated grade.
9. Keep elevations of areas to be turfed **two (2) inch** below proposed adjoining walks, curbs, slabs, etc., and areas of planters **three (3) inches** below proposed improvements.

3.4 FIELD QUALITY CONTROL

A. Site Tests:
1. Required field test reports on placed fill materials. Test will be performed by the Owner's Testing Laboratory Agency in accordance with the Specification Section – TESTING LABORATORY SERVICES.
2. Testing Agency will test compaction of soils in place according to ASTM D 1556 "Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method"; ASTM D 2167 "Standard test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method"; ASTM D 2922 "Standard test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)"; and ASTM D 2937 "Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method," as applicable. Tests will be performed at the following locations and frequencies:
    a. Paved and Building Slab Areas: At sub-grade and at each compacted fill and Back Fill layer.
    b. Foundation Wall Back Fill: At each compacted Back Fill layer.
    c. Trench Back Fill: At each compacted initial and final Back Fill layer.
3. Costs of initial compaction tests shall be borne by the Owner. Contractor shall pay for all re-tests and re-inspection required due to failure of initial tests.

B. Inspection:
1. As required by Regulatory Requirements.
2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
3. No work shall be without the inspections required by Regulatory Requirements.
4. Testing Agency: Owner will engage a qualified independent Geotechnical Engineering testing agency to perform field quality-control testing.
5. Allow testing agency to inspect and test sub-grades and each fill or back fill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

3.5 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and re-compact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, back fill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.6 CLEANING

A. Disposal of Surplus and Waste Materials:
   1. Remove surplus satisfactory soil material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's Property.

END OF SECTION

SECTION 31 23 33 - TRENCH EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Geotechnical Report prepared by Technicon Engineering Services, Project number 230573.001 dated December 19, 2023

1.2 SUMMARY:

A. SECTION INCLUDES
1. Excavating trenches, holes and pits for constructing the Work.
2. Backfill and compaction.
3. Providing suitable bedding and backfill material, as specified herein.

B. RELATED SECTIONS
1. Contract General Conditions and Division 01, General Requirements.
2. Section 33 40 00 - Storm Drainage

1.3 REFERENCES

A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

1.4 DEFINITIONS

A. Utility: Any buried or above ground pipe, conduit, cable, associate devices or appurtenances, or substructure pertaining hereto.

1.5 QUALITY ASSURANCE

A. Qualifications

1. Installer:

a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this project within the past 5 years.

B. Regulatory Requirements:

1. In accordance with Specification Section REGULATORY REQUIREMENTS and the following:

a.	CARB	Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board [CARB].
b.	CM	City of Merced, Codes and Ordinances
c.	EPA	Environmental Protection Agency.
d.	CAL/OSHA	Comply with all provisions of the Construction Safety Orders and the General Safety Orders of the California Division of Occupational Safety and Health, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground excavations.

C. Certificates:

1. Installer's certification that all trench backfill installation meets or exceeds the requirements of this specification.
2. Contractor's certification (on Contractor's letterhead paper) that the trench backfill materials and installation meets or exceeds the requirements of this specification.

D. Meetings:

1. Pre-Installation: Schedule prior to the start of work.

a. Coordinate the work with other work being performed.
b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.

2. Progress: Scheduled by the Contractor during the performance of the work.

a. Review for proper installation of work progress.
b. Identify any installation problems and acceptable corrective measures.
c. Identify any measures to maintain or regain project schedule if necessary.

3. Completion: Scheduled by the Contractor upon proper completion of the work.

a. Inspect and identify any problems which may impede issuance of warranties or guaranties.

4. Maintain installed work until the Notice of Substantial Completion has been filed.

1.6 COORDINATION

A. Coordinate work with Owner's personnel.

B. Verify that the location of existing utilities have been indicated at work site by utility authorities.

1.7 EXISTING UTILITIES

A. Where subsurface work involves more than the normal depth of excavation required for the removal and/or construction of surface improvements (surface improvements such as concrete work, paving, landscaping, signs, etc.), the Engineer will have made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

B. Under circumstance similar to 31 23 33/1.7A, service laterals and appurtenances will have also been shown where information was available as to their location. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

C. Determine exact location of existing buried utilities by:

1. Marking on ground or pavement surface the alignment and extent of the proposed facilities and the probable location of existing utilities using construction plans and existing surface features.
2. Requesting Underground Service Alert (USA) to indicate location of existing buried facilities (phone 1-800-227-2600). Provide USA a minimum of two (2) working days notice of request for locations, and notify Owner of said request concurrently.
3. Locate exact location of existing utilities by hand methods of excavation, or by use of vacuum equipment.

D. At proposed work location, expose by hand methods (or vacuum equipment) all existing utilities along the route of the proposed work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand (or vacuum equipment) methods to locate all existing facilities as indicated on the plans, and/or as indicated on the ground by USA or Owner's personnel.

E. Provide Field Engineering per Contract General Conditions and Division 01 to record the location of all utilities encountered. Where locational conflicts exist between existing utilities and the planned location of facilities to be constructed under the Contract, submit detailed information to the Owner's Inspector and Engineer for review and direction.

F. Maintain all existing utility mains and service lines in constant service during construction of the Work.

G. Where service disruptions are allowed, minimize the length of such disruptions by proper scheduling and diligent pursuit of the work.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Fill Type as specified in Division 31 Specification Section EARTHWORK.

B. Granular fill used to bed under and around the haunches of utility piping shall be clean, washed sand.

2.2 WARNING TAPE

A. 6” wide warning tape shall be installed over all of the pipelines as shown on the details.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.

B. Protect existing structures, fences, sidewalks, curbs, and other improvements from excavation equipment and vehicular traffic.

C. Maintain and protect above and below grade utilities which are to remain.

D. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.

3.2 EXCAVATION

A. Excavate soil required to locate existing utilities and install the work.

B. Use hand methods of excavation to locate existing utilities, and to excavate trenches, pits and holes in congested areas.

C. Employ equipment and methods appropriate to the work site. Small mechanical excavators may be used only in areas where there is sufficient space so as not to damage adjacent improvements, and where the locations of all existing utilities have been determined by hand methods of excavating.

D. Cut trenches just wide enough to enable installation and proper bedding and backfill, and to allow inspection.

E. Do not interfere with 45 degree (1:1) bearing splay of foundations.

F. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose material.

G. Excavate trenches, pits or holes bottoming in hardpan to a minimum of 6 inches below the grade for the bottom of the pipe and any couplings. No additional payment will be made for such over-excavation and refill.

H. In all trenches or excavation sites where a firm foundation is not encountered, such as soft, spongy, or otherwise unsuitable material, remove the material to a minimum of 12 inches, or to a depth determined by the Engineer, below the bottom of the proposed pipe or structure, and backfill the space with Earth Fill material containing sufficient moisture to allow compaction to 92% maximum dry density (relative compaction). . No additional payment will be made for such additional excavation or backfill.

I. Excavate trenches to provide the design grade of the facility, or as directed by the Engineer.

J. Stockpile excavated material to be returned to trench adjacent thereto in location which will not be detrimental to existing improvements, or pedestrian or vehicular traffic. Remove from site all unsuitable or excess material not to be used.

K. When excavating through tree roots, perform work by hand and cut roots, where authorized, with a saw.

L. Remove excess soil not used as backfill from the work site. Obtain a disposal site off of the Owner's property and legally dispose of said excess material, all at no additional cost to the Owner.

M. If water is encountered during excavations, provide all dewatering measures necessary to construct improvements shown.

N. Contractor shall make all provisions necessary, including but not limited to, shoring or sloping back trench walls as required to address sandy soils. The cost of these provisions shall be included in the lump sum amount bid for this work and no separate payment will be made therefore.

3.3 PROTECTION OF EXCAVATIONS

A. Provide all shoring and bracing as required and those codified in local, state and federal safety regulations.

B. Prevent water, caving or sloughing ground from entering excavations.

C. Maintain excavations free of water.

3.4 BACKFILLING

A. Provide type granular pipe bedding as required by Plans and compact to 92% maximum dry density.

B. After installation of pipes and appurtenances and placement of pipe bedding material, backfill trenches and excavations to finished grade, or subgrade in areas to receive surface improvements

C. Backfill trenches to a minimum of 12 inches above the pipe and any couplings with granular fill material, containing sufficient moisture to allow compaction to 92% maximum dry density. Soil Type S2 shall meet requirements of Type S5.

D. Employ a placement method that does not disturb or damage existing or proposed pipes or other Utilities or Improvements.

E. Place and compact all soil backfill in continuous layers not exceeding 8 inches in loose uncompacted thickness, moisture condition to at least 3% above optimum moisture content.

F. Maintain optimum moisture content of fill materials to attain required compaction.

G. Compact backfill below the top 12-inches to 92% maximum dry density.

H. In areas to receive buildings, structures, or concrete flatwork, compact the top 12-inches to 92% maximum dry density.

I. In areas to receive asphalt concrete pavement or concrete pavement subject to vehicular traffic, compact the top 12-inches to 95% maximum dry density.

J. In planting areas, compact the top 12-inches to 85% maximum dry density.

3.5 TOLERANCES

A. Top Surface of Backfill under Paved or Concrete Areas: Plus or minus 0.02 feet from required elevations.

B. Top Surface of General Backfilling: As required for finish surface to match adjacent improvements or ground.

3.6 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of General Conditions and/or Division 1.

B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.

C. If tests indicate work does not meet specified requirements, recompact, and retest. Retests required due to failure of initial tests shall be paid for by the Contractor.

3.7 PROGRESS AND PROSECUTION

A. Backfill any excavation opened in any day on that same day.

END OF SECTION

SECTION 31 31 00– SOIL TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to provide Termite Control and Herbicide, and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 03 30 00 CAST-IN-PLACE CONCRETE
   4. 31 20 00 EARTHWORK
   5. 32 12 00 PAVEMENT
   6. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
   7. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
   1. Product Data for each type of product specified:
      a. Include the EPA Registered Label showing the Active Ingredients and their percentages.
   2. Quality Assurance/Control Submittals:
      a. Certificates:
         1) Indicating compliance with applicable regulations for all products, signed by product manufacturer.
         2) Installers Qualification for products specified.
      b. Manufacturer's written Instructions for each type of product specified:
      c. Test reports:
         1) Soil Treatment application.
   3. Closeout Submittals:
      a. Project Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.
         1) Identify and accurately locate extent of treatment on the Site Plans.
      b. Warranty in accordance with Specification Section - WARRANTIES.
         1) Special Warranty specified within this specification section.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Material Qualifications:
      a. All products shall comply with all applicable EPA regulations and standards in the place where the Project is located, and in effect at the time of application.
      b. Obtain termite control products from a single manufacturer for each product.
   2. Installer Qualifications:

a. A specialist who is EPA approved and licensed according to regulations of authorities having jurisdiction to apply termiticides and herbicides in the jurisdiction where the project is located.

B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS and the following:
a. EPA Environmental Protection Agency – All Applicable Environmental Protection Regulations and Standards.
b. USDA United States Department of Agriculture.
c. All products will comply with the current EPA laws and California Rules and Regulations at the time of application. Should the products listed become unavailable because of changes in the law, submit substitute products in accordance with Section - SUBSTITUTION PROCEDURES for review by the Architect.

C. Meetings:
1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
a. Coordinate the work with other work being performed.
b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
a. Review for proper installation of work progress.
b. Identify any installation problems and acceptable corrective measures.
c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.4 PROJECT CONDITIONS

A. Environmental requirements:
1. To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

B. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

1.5 SEQUENCING AND SCHEDULING

A. Coordination:
1. Coordinate soil treatment application with excavating, filling, grading, and concrete operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.6 WARRANTY

A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
1. Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
2. In accordance with manufacturer's written standard warranty:
a. Warranty Period Five (5) Years.
1) From the date of Substantial Completion.

C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES:
a. Warranty period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 TERMITICIDE

A. PREMISE® 75 insecticide in water soluble packets as manufactured by BAYER CORPORATION, delivered in a minimum of a 0.1 percent solution as indicated by the label and in accordance with local environmental regulations, or approved equivalent.
1. Active Ingredients:
a. Imidacloprid, 1-((6-Chloro-3-pyridinyl)methyl)-*N*-nitro-2-imidazolidinimine: 75.0 percent.
b. Inert Ingredients: 25.0 percent.
c. Total: 100.0 percent.

B. WISDOM TC Flowable use a 0.06 percent emulsion for subterranean Termites.
1. Active Ingredients:
a. Bifenthrin: 7.9 percent.
b. Other ingredients: 92.1 percent.

2.3 HERBICIDE

A. Commercial chemical for weed control registered by the EPA and the State of California. Provide granular, liquid, or wettable powder form.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Termiticide:
1. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.
a. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings.
1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION

A. General:
1. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

B. Applying Termiticide for Pre-Construction Treatment:
1. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide per the soil conditions present, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticide barrier or treated zone is established around and under building construction. Distribute treatment evenly.
a. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
1) If the slab-on-grade construction is applied directly over the vapor retarder/barrier, then apply the termiticide just under the vapor retarder/barrier just prior to it's placement. Spray all penetrations on top of the vapor retarder/barrier after it is placed and sealed, and just prior to the placement of the concrete.

2) If the slab-on-grade construction is applied over a sand layer laid on top of the vapor retarder/barrier, then apply the termiticide directly over the sand layer just prior to the placement of the concrete.

b. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

c. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.

d. Masonry: Treat voids.

e. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

2. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

3. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

4. Post warning signs in areas of application.

5. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

C. Applying Termiticide for Post-Construction Treatment:

1. New construction shall always require Pre-Construction Treatment.

2. Only if the project involves Modernization and Termiticide

3. Treatment is required, follow product label instructions for Post-Construction Treatment.

D. Applying Herbicide Treatment:

1. Extent of Herbicide Application: Soil under all asphaltic concrete paving, including driveways, parking areas, and athletic courts.

2. Application:

a. Prepare substrate in accordance with manufacturer's written recommendations.

b. Apply Herbicide Solution over sub-base prior to application of asphaltic concrete.

c. Apply in form allowed by the EPA label.

d. Rate of Application: As recommended by the label.

e. Take all precautions to limit herbicide treatment to areas immediately under paved areas.

3.4 FIELD QUALITY CONTROL

A. Soil Treatment Application Report: After application of soil treatment is completed, submit report for Owner's record information, including the following:

1. Date and time of application.

2. Moisture content of soil before application.

3. Brand name and manufacturer of termiticide.

4. Quantity of undiluted termiticide used.

5. Dilutions, methods, volumes, and rates of application used.

6. Areas of application.

7. Water source for application.

END OF SECTION

SECTION 32 01 90: EXISTING LANDSCAPE PROTECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes but is not limited to the following:
   1. Protection and maintenance of existing trees and other plants that are affected by the execution of the Work, whether temporary or new construction.

B. Related Work Specified Elsewhere
   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections.
   2. Section 31 11 00: Site Clearing
   3. Section 31 20 00: Earthwork
   4. Section 31 23 33: Trench Excavation and Backfill
   5. Section 32 84 00: Irrigation System
   6. Section 32 90 00: Landscape Planting

1.2 SUBMITTALS

A. Product Data: For each type of product indicated or proposed for use.

B. Qualification Data: Submit arborist's certification and/or license information. Submit qualifications and experience of the certified tree worker if not the arborist.

C. Project Certification: Provide a certification letter from the consulting arborist that trees indicated to remain have had their Tree Protection Zone (TPZ) protected during construction according to these specifications and/or the arborist's recommendations. Provide a list of any trees damaged during construction and the subsequent treatment and repair.

D. Transplanting and Maintenance Recommendations: Submit maintenance and protection specifications from a qualified arborist for care and protection of trees during and after completion of the Work that are likely to be affected by construction operations. The tree maintenance recommendations shall be included in the Maintenance Manuals required in 329000.

E. Tree Assessment and Valuation: Prior to the start of any construction operations of any kind, submit a tree assessment including tree valuation for existing trees scheduled to remain in the area of work or in auxiliary construction areas.
   1. Tree valuation for trees species that do not have comparable and available replacement sizes shall be determined by a certified consulting arborist experienced in tree valuation using the "Guide for Establishing Values of Trees and Other Plants", current edition, published by the International Society of Arboriculture, Urbana, Illinois.
   2. Tree assessment shall include a physical description, health, condition and recommended pruning and/or mitigation measures based on the expected construction operations to minimize the negative impacts to the affected trees.

1.3 QUALITY ASSURANCE

A. Tree Service Qualifications: An experienced tree service firm that has successfully completed tree protection and/or relocation work similar to that required for this Project, and who will provide experienced, certified tree workers.

B. Arborist Qualifications: The arborist shall be certified by the International Society of Arboriculture. If the arborist is performing tree work, he/she shall be employed by a licensed contractor, or shall hold an individual license if independent.

C. Tree Pruning Standards: Comply with ANSI A300, "Trees, Shrubs, and Other Woody Plant Maintenance--Standard Practices," unless more stringent requirements are indicated or recommended by the certified arborist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.

B. Topsoil: See Section 32 93 00.

C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers, minimum 4.8 oz/sq. yd.

D. Temporary Fencing at the TPZ: Heavy-duty exterior rated plastic or chain link fencing, minimum four feet high with stakes at a maximum 10 feet on-center or as needed for a taut installation.

E. Wood mulch: Walk-on type chipped wood and aged greenwaste material without leaves, green wood, sticks, dirt, dust, construction materials and other debris. Particle size 1/2” to 3" in general size.

F. Coarse sand: Clean sand with greater than 95% passing a #10 seive, less than 5% passing a #30 seive, and less than 1% passing a #50 seive.

2.2 TEMPORARY TPZ FENCING TYPES

A. TPZ 1: Temporary fencing shall be installed at the drip line of the tree canopy. Where the canopy extends into remaining or proposed hardscaped areas, the posts may be supported by appropriate on-grade concrete or weighted bases.

B. TPZ 2: Where existing trees are in planting strips with active walkways and/or roadways in the TPZ, the temporary fencing shall extend to the edge of the hardscaped areas to keep the walkways and/or roadways open.

C. TPZ 3: Existing trees remaining in small planters or tree wells shall be wrapped with a minimum 2 inch thickness of orange plastic construction fencing from the ground to the first scaffold branch, or 4 feet high, whichever is greater. The wrapped section shall be

covered with vertical 1.5 inch square slats and bound around the trunk firmly at least every 2 feet. Use caution when installing the slats so that the tree bark is not damaged.

PART 3 - EXECUTION

3.1 PREPARATION

A. Temporary Fencing: Install temporary fencing located around the canopy drip line of trees (the tree protection zone [TPZ]), and around the plants scheduled to remain that are inside the construction area. The TPZ fence layout shall be reviewed for acceptance by the Owners Representative and the consulting arborist.

B. All work within the TPZ shall be reviewed and monitored by the consulting arborist.

C. Within the TPZ, install a 4 inch depth of wood mulch over a permeable filter fabric with minimum 4 inch overlaps at fabric seams. Remove the protection mulch and fabric prior to any cultivation and amendment tillage.

D. Provide a temporary dirt berm watering basin around trees and plants scheduled to remain. The berm around trees shall be a minimum diameter of six times (6x) the diameter of the tree at breast height (DBH), or not less than six feet in diameter, whichever is greater.

E. Provide temporary irrigation or a portable water source to irrigate trees and plants scheduled to remain. Irrigate at minimum once a week or more often as necessary to moisten soil to a minimum 18 inch depth for trees, and a minimum depth of 12 inches for shrubs. Reapply irrigation based on an evapotranspiration loss of 50%.

F. Protect plant/tree root systems within the protected fenced areas from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.

G. Do not store construction materials, debris, or excavated material within the TPZ. Do not permit vehicles or reoccuring foot traffic within the TPZ to prevent soil compaction over root systems.

H. Do not allow fires under or adjacent to remaining trees or other plants.

3.2 EXCAVATION

A. Do not excavate within the canopy drip line of existing trees unless otherwise authorized. Any excavation within the TPZ shall be performed under the onsite monitoring by the consulting arborist.

B. Where excavation for new construction and/or utility lines are required within the canopy drip line of trees, hand clear and excavate to minimize damage to root systems. Use spading forks to comb soil or use an Air-Spade to expose roots.

C. Where utility lines are to be located within the drip line of trees, expose the existing root system to the depth of utility line installation plus the depth of any required bedding

material. Place piping below and/or through the exposed roots without damage to the root system. Backfill with approved material and compact by flooding the area if allowed.

D. As an alternative to manual or Air-Spade trench excavation, utility or other below grade piping may be mechanically bored under the crown dripline with a minimum cover of 3 feet as authorized by the consulting arborist.

E. Root Pruning: Do not cut main lateral roots or taproots greater than one inch in diameter. Smaller roots less than one inch in diameter that interferes with the installation of new improvements and/or utility lines may be cut only if absolutely necessary. Only cut roots with sharp pruning instruments; do not break, tear or chop. Block out concrete footings around roots greater than one inch diameter leaving a minimum one inch clearance around roots to remain. Provide alternative footing design if main lateral roots are in conflict.

3.3 REGRADING

A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by the certified arborist, unless otherwise indicated.
   1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots less than one inch diameter. Cut roots with sharp pruning instruments; do not break or chop.

B. Minor Fill: Where existing grade is 12 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations. Do not place fill greater than 6 inches in depth within 24 inches of the trunk, and do not cover the trunk/root base flare. Do not allow standing water at the trunk.

C. Moderate Fill: Where existing grade is more than 12 inches , but less than 18 inches below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:
   1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of existing grade and extend not less than 20 inches from tree trunk on all sides up to the finish grade. Slope of the rock fill shall be a maximum 2h:1v. For balance of area within drip-line perimeter, place drainage fill a minimum 6 inches in depth.
   2. Place filter fabric over the drainage fill with edges overlapping 6 inches minimum.
   3. Place fill layer of topsoil to finish grade. Do not mechanically compact drainage fill or topsoil more than 85% relative density in planted areas. Hand grade to required finish elevations.

3.4 TREE PRUNING

A. Prune remaining trees affected by temporary and new construction only when authorized by the Landscape Architect and as recommended by the consulting arborist.

B. Prune remaining trees to compensate for root loss caused by damaging or cutting root system only when authorized by the Landscape Architect and as recommended by the

consulting arborist. Provide subsequent maintenance during Contract period as recommended by the consulting arborist.

C. Pruning Standards: Prune trees according to ANSI A300 based on pruning for access clearance, to correct any defects in structure, or to remove potential conflicts with new improvements. Pruning shall only be performed by a Certified arborist or tree worker.

D. Cut branches with sharp pruning instruments; do not break or chop. Clean pruning tools with a diluted bleach solution prior to performing any pruning operations.

3.5 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the arborist.

B. Remove and replace dead and/or damaged trees impacted by the construction operations that the arborist determines to be incapable of restoring to a normal growth pattern.
   1. Provide new trees of the same size and species as those being replaced; plant and maintain as specified in 32 90 00.
   2. When new trees of the same size and species are not available, furnish and install the largest size boxed tree that is readily available and will successfully grow in the planting area with long term health and without damage to adjacent improvements. Credit the Owner the difference between the valuation of the removed existing tree and the installed replacement tree.

C. Aerate surface soil within any existing Oak tree dripline compacted before or during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 18 inches deep at 36 inches o.c. Backfill holes with coarse sand. Manually till the top 4 inches with a spading fork, and break up clods greater than 1 inch diameter. Smooth grade prior to installing wood mulch.

3.6 CLEAN-UP

A. Burning is not permitted.

B. Prior to Final Acceptance, remove the TPZ fence, stakes and other related materials.

C. Legally remove excess excavated material, debris, displaced trees, and greenwaste from Owner's property. Broom clean all hardscape surfaces in the area of work.

END OF SECTION

SECTION 32 12 00– PAVEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Provide all material, labor, equipment and services necessary to completely install all pavement materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 02 01 10 EXISTING LANDSCAPE MAINTENANCE
4. 03 30 00 CAST-IN-PLACE CONCRETE
5. 09 91 00 PAINTING
6. 10 14 53 ROAD AND PARKING SIGNAGE
7. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
8. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 REFERENCES

A. Standards:
1. In accordance with the following standards:
2. a. ASTM American Society of Testing and Materials
3. b. FS Federal Specifications
4. c. RIS Redwood Inspection Service
5. d. SS-CDOT Standard Specifications, California Department of Transportation

1.3 SUBMITTALS

A. Submit in accordance with Specification Section – SUBMITTAL PROCEDURES:

B. Product Data.
1. Provide technical data and tested physical and performance properties on any products provided in PART 2.
a. [**Aggregate Base,**][**Tack Coat,**][**Asphalt Concrete,**][**Geosynthetic Interlayer,**][**Sealers,**]**Markings,**][**Joint Sealant,**][**and Headers**].
2. Submit manufacturer's full color range (including any standard and premium colors) for selection by the Architect.

C. Samples.
1. Provide 3 inch long samples of each color of Markings[**and Coatings**].
2. Provide 12 inch square sample of each Geosynthetic Interlayer.

D. Quality Assurance/Control Submittals:
1. Design Data:

a. Provide Job-Mix Design for each proposed Job-Mix indicating aggregate gradation for the sieve sizes specified and the amount (percent by dry weight of aggregate) of asphalt to be used.

2. Test Reports:
   a. Compaction of Aggregate base test results.
   b. In-place compacted thickness of aggregate base and asphalt paving.
   c. Stockpiled pulverized asphalt.
      1) Sieve Analysis
      2) Maximum Density/Optimum Moisture
      3) Resistance Value
3. Certificates:
   a. Contractor's Letterhead Statement
   b. Applicator's Letterhead Statement
   c. Statement of installer's qualifications

E. Closeout Submittals:
   a. Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.
   b. Warranties:
      1) Contractor's General Warranty.
      2) Manufacturer's Warranty.
      3) Installer's Warranty.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Installer Qualifications:
   a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
2. Manufacturer/Supplier Qualifications:
   a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

B. In accordance with Specification Section - REGULATORY REQUIREMENTS.

C. Certificates:
1. Provide Contractor's Letterhead Statement certifying work provided meets or exceeds the requirements of this Section.
2. Provide Applicator's Letterhead Statement certifying products are in accordance with the manufacturer's specifications and standards requirements.

D. Meetings:
1. Pre-Installation: Scheduled by the Contractor prior to the start of any construction or aggregate base rock preparation.
   a. Coordinate the work with all other related work being performed.
   b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
   c. Review requirements of work performed by others that rely on substrates exposed by selective demolition work.
   d. Review areas where existing construction is to remain and requires protection.
   e. Review demolition waste disposal and material recycling procedures.
2. Progress: Scheduled by the Contractor during the performance of the work.

a. Review for proper installation of work progress.
b. Identify any installation problems and acceptable corrective measures.
c. Identify any measures to maintain or regain project schedule if necessary.

3. Completion: Scheduled by the Contractor upon proper completion of the work.
   a. Inspect and identify any problems that may impede issuance of warranties.
   b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
   1. Products shall be handled in such a manner as to assure that they are free from defects or other damage.

B. Acceptance at Site:
   1. Products must be in manufacturer's original unopened containers with labels indicating brand name, grade, source location and date of manufacture.
   2. Damaged products will not be accepted.

C. Storage and protection:
   1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
      a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.6 PROJECT CONDITIONS

A. Environmental requirements:
   1. Dust control:
      a. Perform work in a manner as to minimize the spread of dust and flying particles.
      b. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other work.
   2. Burning:
      a. No burning will be allowed on-site.
   3. Rain:
      a. Work under this section shall not be started or continue under threat of rain.
      b. Asphalt Concrete shall not be placed when the surface is wet or frozen.
   4. Temperature:
      a. Actual selection of Asphaltic Concrete by the applicator depends on the time of the year for the application and whether or not High or Low temperature Asphaltic Concrete is used. Verify anticipated temperature ranges and verify with the Architect prior to selection.

B. Existing Conditions:
   1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
   2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

1.7 WARRANTY

A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:
1. In accordance with manufacturer's written standard warranty:
a. Warranty period One (1) Year.

C. Installer's Warranty:
1. In accordance with the terms of the specification section - WARRANTIES, but the period of time shall be for One (1) year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
1. Specified paving fabric product manufacturer:
a. TENCATE "Mirafi MPV500"
b. Acceptable alternative manufacturers:
1) PROPEX "Petromat 4598"
2. Specified traffic paint product manufacturer:
a. ENNIS TRAFFIC SAFETY SOLUTIONS Standard Dry Waterborne Traffic Paint.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 MATERIALS

A. Aggregate Base:
1. Three-fourths (3/4") inch grade, Class 2, in accordance with SS-CDOT Section 26, "Aggregate Bases."

B. Tack Coat:
1. Asphaltic Emulsion:
a. Type SSI or CSSI, slow-setting per SS-CDOT Section 94 "Asphaltic Emulsions."

C. Primer Coat:
1. Asphaltic Emulsion:
a. Type SSI asphalt emulsion per SS-CDOT Section 94 "Asphaltic Emulsions" diluted with water to 5 parts water to 1 part asphaltic emulsion.

D. Asphalt Concrete:
1. Asphalt Binder:
a. Type PG 64-10 per SS-CDOT Section 92 "Asphalts."

2. Aggregate:
    a. Type B in accordance with SS-CDOT Section 39 "Hot Mix Asphalt."
        1) Provide one-half inch (1/2") aggregate at playcourt, tennis and basketball courts, walkways, and playground areas.
        2) Provide three-fourths inch (3/4") aggregate at on-site parking lots, roadways, and driveways.

E. Geosynthetic Interlayer:
1. Paving Fabric:
    a. Polypropylene nonwoven needle-punched fabric.
    b. Interlayer shall meet the following minimum performance characteristics:
        1) Unit Weight 4.1 oz/sq yd min.
            a) Per ASTM D 5261 "Standard Test Method for Measuring Mass per Unit Area of Geotextiles."
        2) Bursting Strength 200 psi min.
            a) Per ASTM D 3786 "Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method."
        3) Elongation 50 percent min.
            a) Per ASTM D 4632 "Standard Test Method for Grab Breaking Load and Elongation of Geotextiles."
        4) Asphalt Retention 0.20gal/sq yd min.
            a) Per ASTM D 6140 "Standard Test Method to Determine Asphalt Retention of Paving Fabrics Used in Asphalt Paving for Full-Width Applications."
        5) Melting Point 325 deg F. min.
            a) Per ASTM D 276 "Standard Test Methods for Identification of Fibers in Textiles."

F. Sealers:
1. Fog Seal:
    a. In accordance with SS-CDOT Section 37-2 "Seal Coats" and Section 94 "Asphaltic Emulsions."
        1) Section 37-2.04 "Payment" is exempt from this specification.
    b. Asphaltic emulsion shall be any of the slow setting grades.
    c. Water shall be potable.

2.3 ACCESSORIES

A. Markings:
1. Paint:
    a. In accordance with SS-CDOT Section 84-3 "Painted Traffic Stripes and Pavement Markings."
        1) Section 84-3.04 "Payment" is exempt from this specification.
    b. Waterborne latex paint meeting Federal Specification TT-P-1952E, Type II.

B. Joint Sealant:
1. Hot-applied, single component, polymer-modified bituminous sealant meeting ASTM D 6690 "Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements," Type I, II, or III.

C. Headers:
1. Rough Sawn, Construction Heart grade redwood per RIS.
2. RIS Grade mark shall appear on each piece of header lumber.

3. Stakes shall be rough sawn redwood.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
   1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual which affect the execution of work under this specification section.
      a. Verify subgrade has been compacted to relative compaction required and is within allowable moisture content.
      b. Verify gradients and elevations of base are correct.
      c. Verify stockpiled pulverized asphalt is suitable for using as Class 2 aggregate base by reviewing test reports.
   2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
   3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
   2. Do not begin work until **sub-grade** is in a condition satisfactory to the Architect **and Geotechnical Engineer**.

B. Protection:
   1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

C. Surface preparation:
   1. Completely proof-roll subgrade and/or aggregate base to identify soft pockets and areas of excess yielding.
      a. Do not proof-roll when wet or saturated conditions exist.
      b. Excavate soft spots, unsatisfactory subgrade or base, and areas of excessive pumping or rutting and replace with compacted backfill per Specification Section - EARTHWORK or Aggregate Base.
   2. Coordinate with Specification Section – SOIL TREATMENT for application of herbicides.
   3. Prepare surface in accordance with manufacturer's written instructions and recommendations.

3.3 INSTALLATION

A. General:
   1. In accordance with manufacturer's instructions and recommendations unless specifically noted otherwise.
   2. In accordance with approved submittals.
   3. In accordance with Regulatory Requirements.

B. Layout:
1. Lines shall be straight and true.

C. New Pavement:
1. Aggregate Base:
a. Install Aggregate Base over approved sub-grade.
b. Thickness shall be as indicated.
c. Compaction of each layer shall be not less than 95 percent as determined by Caltrans California Test Method No. 216 "Method of Test for Relative Compaction of Untreated and Treated Soils and Aggregates," in accordance with SS-CDOT.
d. Recycled Asphalt as Aggregate Base:
1) Remove deleterious debris, organics and pieces larger than 3 inches encountered within the stockpile before placement.
2. Geosynthetic Interlayer:
a. Install in accordance with SS-CDOT Section 39-1.09D
b. Spray Tack Coat at a rate of 0.22 to 0.28 gal/sq. yd. and then promptly lay down the interlayer in accordance with manufacturer's written recommendations.
c. Broom or roll smooth and free of wrinkles and folds.
d. Protect form traffic and other damage and place asphalt concrete paving overlay the same day.
3. Tack Coat:
a. Apply uniformly to vertical surfaces abutting or projecting into new asphalt concrete paving at a rate of 0.05 to 0.15 gal/sq. yd including concrete curbs and utility boxes.
1) Allow tack coat to cure undisturbed before applying asphalt concrete paving.
2) Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
4. Asphaltic Concrete paving:
a. Contact Architect **and Geotechnical Engineer** 72 hours prior to installation.
b. Thickness shall be as indicated.
1) Where thickness exceeds 2 inches, place in no less than two layers.
c. Compaction Equipment:
1) In accordance with SS-CDOT Section 39 "Hot Mix Asphalt." At small difficult areas, equipment may be altered as approved by the Architect **and Geotechnical Engineer**.
d. The completed surface shall be thoroughly compacted, free from ruts, depressions, and irregularities, and be true to grade, slope and cross-section so that no standing water occurs.
e. Tolerances:
1) Flatness: Maximum variation of 1/4 inch measured with a 12 foot straight edge.
2) Thickness: Not less than specified thickness.

3.4 APPLICATION

A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.

B. Layout:
1. Lines shall be straight and true.

C. New Pavement:
1. Sealers:
a. Allow Asphaltic Concrete to cure 21 days minimum.
b. Broom clean asphaltic concrete.
c. Apply in accordance with SS-CDOT Section 37 "Bituminous Seals."
d. The finished surface shall be smooth and uniform in appearance.
1) Apply Fog Seal **at all pavement**at the application rate of 0.02 to 0.06 gal/sq. yd.

D. Markings:
1. Allow Asphalt Concrete and Seal coats to cure per manufacturers recommendations before applying paint.
2. Sweep and clean surface to eliminate loose material and dust.
3. Apply uniform, straight, and true markings with equipment designed for pavement markings. Edges and ends shall be sharp and clean
4. Apply with a minimum dry film thickness of 15 mils.
5. Colors, lengths, and widths as indicated.
a. Width Tolerance shall be plus or minus 1/8 inch.
6. Allow markings to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

3.5 REPAIR

A. Markings:
1. Remove and replace markings that are applied at less than minimum material rates, deviate from true alignment, exceed length and width tolerances, or show light spots, smears, or other deficiencies.
2. When removing markings avoid damage to the surface which the marking was applied. Use carefully controlled sand blasting, approved grinding equipment, or other approved method.

3.6 FIELD QUALITY CONTROLSite Tests:

1. As required by local jurisdiction for off-site development.
2. Compaction of aggregate base:
a. Per CAL Test Method 216-00 "Method of Test for Relative Compaction of Untreated and Treated Soils and Aggregates."
3. In-place compacted thickness:
a. Core and measure thickness of aggregate base and asphalt paving per ASTM D 3549 "Standard Test Method for Thickness of Height of compacted Bituminous Paving Mixture Specimens."
b. Core and measure at high and low elevation points of each road section and parking lot.
4. Stockpiled pulverized asphalt as aggregate base:
a. Sieve Analysis shall be performed per ASTM C 136 "Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates."
b. Maximum Density /Optimum Moisture per CAL Test Method 216-00 "Method of Test for Relative Compaction of Untreated and Treated Soils and Aggregates."

c. Resistance Value per CAL Test Method 301"Method of Test for Determining the Resistance "R Value of Treated and Untreated Bases, Subbases and Basement Soils by the Stabilometer."

5. Drainage:
   a. Water shall not be able to accumulate at any point and the surface shall be free to drain to drainage inlets or gutters.
   b. The paving contractor shall water flood the surface with the use of a water truck. If, after 30 minutes on a 70 degree F day, "bird baths" are evident in a depth more than 0.01 foot, the paving contractor and the Owner's representative will determine the best method of correction.
   c. A 10 foot straightedge shall be used to check for high spots and ridges. High spots and ridges out of compliance shall be reduced by a remedy determined by the paving contractor and the Owner's representative.
6. Should a section of the work be not acceptable on the basis of inadequate compaction and/or the mixture becomes loose and broken, mixed with dirt, out of tolerance, or in any other way defective, it shall be repaired or removed and replaced with fresh mixture and immediately compacted to conform to the surrounding area to the satisfaction of the Owner.

B. Inspection:
1. As required by local jurisdiction for off-site development.
2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
3. No work shall be done without the inspections required.

3.7 CLEANING

A. Clean in accordance with Specification Section - TEMPORARY FACILITIES AND CONTROLS.
1. Clean any soiled surfaces immediately.
2. In accordance with manufacturer's instructions and recommendations.

3.8 PROTECTION

A. Protection from traffic:
1. No traffic shall occur over pavement until all materials have fully cured.
2. Maintain in a manner acceptable to manufacturer and installer.
3. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly applied materials.
4. Maintain and protect installed improvements without damage or deterioration until execution of Substantial Completion.

END OF SECTION

SECTION 32 14 00 – UNIT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete pavers.
   2. Curbs and edge restraints.

B. Related Requirements:
   1. ALL DIVISION 00 SPECIFICATION SECTIONS
   2. ALL DIVISION 01 SPECIFICATION SECTIONS
   3. 03 30 00 CAST IN PLACE CONCRETE
   4. ALL FACILITY SERVICES SUBGROUP SPECIFICATION SECTIONS

1.2 PREINSTALLATION MEETINGS

1. Preinstallation Conference: Conduct conference at **Project site**.

1.3 ACTION SUBMITTALS

1. Product Data:
2. For materials other than water and aggregates.
3. For the following:
   a. Pavers.
   b. Edge restraints.

B. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C136.

C. Samples for Initial Selection: For each type of unit paver indicated.

D. Samples for Verification: For full-size units of each type of unit paver indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with requirements.
   1. For solid interlocking paving units, include test data for freezing and thawing according to ASTM C67.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified unit paving installer. Installer's **field supervisor** must have Concrete Paver Installer Certification from the Interlocking Concrete Pavement Institute (ICPI) with the following designations:
   1. Commercial Paver Technician Designation.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.7 FIELD CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 CONCRETE PAVERS

A. Concrete Pavers, Solid Interlocking Paving Units: Complying with ASTM C936/C936M[**and resistant to freezing** and **thawing when tested according to ASTM C67**], made from normal-weight aggregates.

1. Thickness: 100 mm.
2. Face Size and Shape:
   a. 3-by-12- inch rectangle.
3. Color: Healdsburg.

2.3 CURBS AND EDGE RESTRAINTS

A. Job-Built Concrete Edge Restraints: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mixed concrete with minimum 28-day compressive strength of 3000 psi.

2.4 AGGREGATE SETTING-BED MATERIALS

A. Graded Aggregate for Base: Sound, crushed stone or gravel complying with **ASTM D448 for Size No. 8**.

B. Revise "Sand for Leveling Course" Paragraph below to ASTM C144 for leveling course less than 1 inch (25 mm) thick.

C. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C33/C33M for fine aggregate.

D. Generally, retain "Sand for Leveling Course" Paragraph above and delete "Stone Screenings for Leveling Course" Paragraph below. See the Evaluations.

E. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve.

1. Provide sand of color needed to produce required joint color.

F. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications; made from polyolefins or polyesters, with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2, AASHTO M 288.
2. Apparent Opening Size: No. 60 sieve, maximum; ASTM D4751.
3. Permittivity: 0.02 per second, minimum; ASTM D4491.
4. UV Stability: 50 percent after 500 hours' exposure, ASTM D4355.

G. Drainage Geotextile: Nonwoven needle-punched geotextile fabric, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2, AASHTO M 288.
2. Apparent Opening Size: No. 40 sieve, maximum; ASTM D4751.
3. Permittivity: 0.5 per second, minimum; ASTM D4491.
4. UV Stability: 50 percent after 500 hours' exposure, ASTM D4355.

H. Herbicide: Commercial chemical for weed control, registered with the EPA. Provide in granular, liquid, or wettable powder form.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive unit paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Where unit paving is to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations, including areas where waterproofing system is turned up or flashed against vertical surfaces.

C. Proceed with installation only after unsatisfactory conditions have been corrected[**and waterproofing protection is in place**].

3.2 PREPARATION

A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

C. Proof-roll prepared subgrade according to requirements in Section 312000 "Earth Moving" to identify soft pockets and areas of excess yielding. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive **base** course for unit pavers.

3.3 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

1. For concrete pavers, a block splitter may be used.

D. Handle protective-coated brick pavers to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces before setting brick.

E. Joint Pattern: [**Running bond**] [**Herringbone**] [**Basket weave**] [**Grid**] [**As indicated**] [**Match and continue existing unit paver joint pattern**].

F. Tolerances:

1. Do not exceed[**1/16-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches and**] 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.

G. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after unit paver installation.

2. Install job-built concrete edge restraints to comply with requirements in Section 033000 "Cast-in-Place Concrete."

H. Provide steps made of pavers as indicated. Install paver steps before installing adjacent pavers.

1. Where pavers set in mortar bed are indicated for steps constructed adjacent to pavers set in aggregate setting bed, install steps and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.

3.4 AGGREGATE SETTING-BED APPLICATIONS

A. Compact soil subgrade uniformly to at least **95** percent of **ASTM D698** laboratory density.

B. If retaining paragraph above, retain first paragraph below for aggregate setting-bed applications where paving will be subjected to heavy traffic. Delete below if deleting paragraph above.

C. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Revise overlap in first paragraph below to 24 or 36 inches (600 or 900 mm) for weak subgrade soils. Delete if geotextile is not required.

E. Place separation geotextile over prepared subgrade, overlapping ends and edges at least 12 inches.

F. Place aggregate base, compact by tamping with plate vibrator, and screed to depth indicated.

G. Retain last paragraph above or first paragraph below, or delete both, if subbase and base are specified in another Section. Retain above for light-traffic uses; retain below for heavy-duty applications. Delete subbase if not required. Compaction below is an example only, although 100 percent compaction is usually easily achieved with highly granular materials used for base and subbase; revise to suit Project. ASTM D1557 is generally used instead of ASTM D698 for highly granular material when maximum compaction is required.

H. Place aggregate[**subbase and**] base, compact to 100 percent of ASTM D1557 maximum laboratory density, and screed to depth indicated.

I. Retain first paragraph below for open-graded base course material to prevent leveling course from washing into subbase or base course.

J. Place drainage geotextile over compacted base course, overlapping ends and edges at least 12 inches.

K. Place leveling course and screed to a thickness of 1 to 1-1/2 inches, taking care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.

L. Treat leveling course with herbicide to inhibit growth of grass and weeds.

M. Set pavers with a minimum joint width of 1/16 inch and a maximum of 1/8 inch, being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed [**3/8 inch**] <**Insert dimension**> with pieces cut to fit from full-size unit pavers.

1. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.

N. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.

1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches (900 mm) of uncompacted pavers adjacent to temporary edges.
2. Before ending each day's work, compact installed concrete pavers except for 36-inch (900-mm) width of uncompacted pavers adjacent to temporary edges (laying faces).
3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches (90 mm) of laying face.
4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and cover leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.

O. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.

P. Do not allow traffic on installed pavers until sand has been vibrated into joints.

Q. Repeat joint-filling process 30 days later.

3.5 REPAIRING AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.

1. Remove temporary protective coating as recommended by coating manufacturer and as acceptable to paver and grout manufacturers.
2. Do not allow protective coating to enter floor drains. Trap, collect, and remove coating material.

END OF SECTION

SECTION 32 15 40 - CRUSHED STONE SURFACING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install decomposed granite surfacing which includes:
   1. Sub-grade Preparation
   2. Base Preparation
   3. Edge restraint
   4. Stabilizer
   5. Compaction
   6. Cleanup

B. Definitions: The word Architect as used herein shall refer to the Landscape Architect or the Owner's authorized representative.

1.2 SUBMITTALS:

A. Procedure: Submittals shall be provided in accordance with Division 01 requirements.

B. Submit aggregate sieve analysis, product specifications and a one pint representative sample of the proposed decomposed granite, with named source.

PART 2 - PRODUCTS

2.1 DECOMPOSED GRANITE

A. Decomposed granite is referred to by the abbreviation (D.G.), or referred to as disintegrated granite. All decomposed granite for non-vehicular surfaces shall conform to the following grading requirements:

Sieve Designation	% Passing
3/8 inch	100
No. 4	90-100
No. 8	75-80
No. 16	55-65

Sieve Designation	% Passing
No. 30	40-50
No. 50	25-35
No. 100	15-20
No. 200	10-15

B. All decomposed granite for vehicular surfaces shall conform to the following grading requirements:

Sieve Designation	% Passing
1/2 inch	95-100
3/8 inch	90-95
No. 4	65-80
No. 8	43-63
No. 16	40-49

Sieve Designation	% Passing
No. 30	30-40
No. 50	20-27
No. 100	10-18
No. 200	10-12

C. The portion of D.G retained on the no. 4 sieve shall have a maximum percentage of wear of 50 at 500 revolutions as determined by AASHTO T96.

D. The portion passing a No. 40 sieve shall have a maximum liquid limit of 25 and maximum plasticity index of 7 as determined by AASHTO T89 and AASHTO T90, respectively.

E. The sand equivalent shall be in the range of 35-55. The R-value shall be a minimum of 71.

F. Crushed aggregate screenings shall be free from clay lumps, vegetative matter and deleterious material.

G. D.G. shall be tan or buff in color.

2.2 SOIL BINDER

A. Binder shall be a non-toxic, colorless, odorless, organic powder that binds D.G. screenings consisting of 95% Psyllium with a minimum 70% Mucilliod content. The binder shall be “Stabilizer” as manufactured by Stabilizer Solutions Inc., (800) 336-2468, FAX: (602) 225-5902, or equal.

2.3 EDGING

A. Aluminum edging: 3/16” x 5 ½”, manufactured from 6063 extruded aluminum alloy of T-6 hardness with interlock system and 5 stake punch outs fabricated in each strip. Stakes 12” long, lock 1/2” below top of edging.
   1. Finish: Black anodized

PART 3 - EXECUTION

3.1 SUBGRADE AND DECOMPOSED GRANITE PREPARATION AND COMPACTION

A. Subgrade under all D.G. shall be scarified to a minimum depth of 12”, graded and compacted to 90% relative compaction.

B. Aggregate base under D.G. surfacing shall be in conformance with SSCDOT Section 26. Aggregate Base

C. After subgrade preparation or base installation, sterilize base or subgrade receiving D.G. surfacing using soil sterilant: Bayer Oust XP, weed and grass preventer, or approved equal.

D. Minimum compaction for pedestrian use D.G. surfaces shall be 85% relative density, and 90% relative density for vehicular use. The Contractor shall provide one compaction test for every 2,000 square feet or fraction thereof.

E. The finish grade shall be even between the headers with no humps or depressions greater than +/- 0.25" after the compaction.

3.2 SOIL STABILIZER AND DECOMPOSED GRANITE INSTALLATION

A. Soil stabilizer shall be thoroughly mechanically blended per the manufacturer's recommendations with the D.G. screenings prior to transport to the job site.
   1. For vehicular and/or pedestrian use, the stabilizer shall be mixed at a minimum rate of 15 lbs. of Stabilizer product per ton of D.G. aggregate.
   2. For tree well use, the stabilizer shall be mixed at a minimum rate of 8 lbs. of Stabilizer product per ton of DG aggregate.
   3. Premixed Stabilizer and D.G. material can be obtained locally by contacting the stabilizer manufacturer and obtaining the location of a local vendor.
   4. Drop spreading of the Stabilizer product over raked D.G. screenings and mixing stabilizer by rototilling is NOT ACCEPTABLE.

B. Place the premixed stabilizer product on the pre-soaked subgrade in maximum 2" lifts. Rake smooth to the desired grade and cross slope.

C. After placement and raking, water the Stabilized D.G. to achieve full depth moisture penetration of the placed product. Apply 25 – 45 gallons per ton to achieve the proper full depth moisture penetration.

D. After 6 – 72 hours for activation, roll the Stabilized D.G material with a 2 to 5 ton double drum roller to achieve finish grade and initial compaction without separation, plowing or any other physical compromise of the aggregate. Utilize a hand tamp at edges, around benches, and sign posts. Do not use a vibratory wacker plate or vibratory roller to compact the Stabilized D.G.

E. Finish surface elevation:
   1. Compacted finish surface of DG shall be flush with headers, paving, mowstrips and/or curbs, unless otherwise indicated.
   2. Compacted finish surface of DG shall be two inches above finish grade in adjacent shrub/ground cover planting areas, unless otherwise indicated.
   3. Compacted finish surface of DG shall be one-half inch above finish grade in adjacent sodded turfgrass planting areas, unless otherwise indicated.
   4. Compacted finish surface of DG shall be flush to finish grade in adjacent seeded or sprigged turfgrass planting areas, unless otherwise indicated.

F. Lightly spray the surface after compaction operations. Allow the finished surfce sufficient time to dry prior to use.

G. Finished surface shall be smooth, uniform and solid with no evidence of chipping or cracking. Cured and compacted pathway shall be firm throughout profile with no spongy areas. Loose

material shall not be present on surface after installation, but may appear after use and according to environmental conditions. Pathway shall remain stable underneath loose granite on top with a “natural” look. Any significant irregularities in path surface shall be repaired to the uniformity of entire installation.

3.3 CLEANUP

A. After all stabilization operations are completed, remove trash, excess materials, empty containers and rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a smooth condition throughout the site.

B. The D.G. surface shall be dragged and a final dressing performed within 48 hours prior to final acceptance.

END OF SECTION

SECTION 32 31 13 – CHAIN LINK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to furnish and install Chain Link Fencing, Gates, Fittings and Accessories necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 30 00 CAST-IN-PLACE CONCRETE
4. 04 22 00 CONCRETE MASONRY UNITS
5. 10 14 53 ROAD AND PARKING SIGNAGE
6. 31 20 00 EARTHWORK
7. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
8. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 REFERENCES

A. Standards:

1. In accordance with the following standards:

a. CLFMI Chain Link Fence Manufacturer's Institute

1.3 SYSTEM DESCRIPTION

A. Fencing Requirements at Preschool and Pre-Kindergarten facilities:

1. General: Fence installation shall eliminate pinch points and sharp elements.
2. Cut all bolt threads flush, maximum two threads exposed.
3. Smooth all rough edges or burrs within fenced play area.
4. Provide plastic caps over all fence fabric edges and wires.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Product Data:

a. Posts, Rails, and Fittings.
b. Chain link Fabric, Reinforcements, and Attachments.
c. Gates, Hardware and Fittings.

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d. Privacy Slats.

2. Shop Drawings:

a. Includes dimension plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, operational clearances and footings.
b. Include coordination of the work in this section with that of related work of other sections for proper interface of the completed work.
1) Coordinate and obtain approvals from the work of other related sections prior to submitting to the Architect.
2) Furnish to contractor as noted under Specification Section - CAST-IN-PLACE CONCRETE for installation of:
a) Hook Bolts.
b) Drop Rod Receiver.

3. Quality Assurance:

a. Certificates:
1) Materials Certification.
2) Installer's Certification.

4. Closeout Submittals in accordance with the following:

a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
b. Project Record Documents in accordance with Specification Section - PROJECT RECORD Documents.
c. Warranty in accordance with Specification Section - WARRANTIES.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer/Supplier Qualifications:

a. Company operating in the United States, having U.S. Manufacturing facility/facilities, experienced in successfully producing/supplying products similar to that indicated for this Project for a minimum of five (5) years and with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

2. Installer Qualifications:

a. Company with successful experience installing similar projects and products in accordance with ASTM F 567 "Practice for Installation of Chain-Link Fence," and have at least five (5) years of experience.

B. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:

a. CBC General Requirements:

1) All gates within the Path of Travel (POT) shall meet all applicable accessible requirement specifications for doors, as defined by DSA/ACS and CBC Requirements.

C. Certifications:

1. Materials Certification: Complying with current ASTM specifications for all manufacturerer's materials.
2. Installer's Certification: certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.

D. Preinstallation Meeting

1. Conduct meeting at Project Site.
2. Review coordination of work specified in the Section and elsewhere.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Deliver fabric, posts, rails, and other manufactured items so as not to be damaged or deformed. Package materials for protection during transportation and handling.
2. Each length of chain-link fabric shall be tightly rolled and firmly tied.
3. Each roll shall carry a tag showing the class of coating, the specified sire size, the mesh size, the length and height of fabric in the roll, ASTM A 392 "Specification for Zinc-Coated Steel Chain-Link Fence Fabric" and the name of mark of the manufacturer.

B. Handling:

1. Unload, and store materials in a manner to prevent bending, warping, twisting, and surface damage.

C. Storage:

1. Stack materials on platforms or pallets, covered with suitable weather tight and ventilated covering to ensure dryness. Do not store materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences, and gates shown on the Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.8 WARRANTY

A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:

1. In accordance with manufacturer's written standard warranty
2. Manufacturer’s standard form in which manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within the specified warranty period.

    a. Failures include, but are not limited to, deterioration of metals, metal finishes, and other materials beyond normal weathering.
    b. Installer shall have manufacturers signed Certified Installer Agreement as a rider to the warranty.
    c. Warranty Period from date of Substantial Completions: Five (5) Years.

C. Installer's Warranty:

1. In accordance with the terms of the Specification Section - WARRANTIES:

    a. Warranty period Five (5) Years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fence:

1. Fabric:

    a. General: Steel Wire Fabric shall comply with ASTM A 392 "Specification for Zinc-Coated Steel Chain-Link Fence Fabric" and CLFMI Product Manual and with requirements indicated.
        1) Steel wire helically wound and interwoven in such a as to provide a continuous mesh without knots or ties.
        2) Fabric to be in one-piece heights measured between top and bottom of outer edge of selvage.

    b. Wire:
        1) Standard: Use 9 gage (0.148 inch) copper bearing steel wire.
    c. Mesh Size:
        1) Standard: 2 inch mesh.
    d. Fabric Selvage: Knuckled at both top and bottom edges.
    e. Protective Coating: ASTM A 392 "Specification for Zinc-Coated Steel Chain-Link Fence Fabric," Type II Zinc-Coated, Class 2 - 2.0 oz./sq.ft., galvanized by the hot-dip process after weaving.
        1) Quality to withstand 6 one minute immersions per ASTM A 239 "*Standard Test Method for Locating the Thinnest Spot in a Zinc (Galvanized Coating on Iron or Steel Articles by the Preece Test (Copper Sulfate Dip)*."

    f. Strength: Wire in completed fabric after galvanization to have 7,000 pounds per square inch minimum tensile strength.

2. Posts:

    a. General: All posts shall be round, seamless or continuously welded, steel pipe complying with ASTM F 1043 "Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework," Group IA, Table 3, Heavy Industrial Fence Framework, schedule 40 pipe per ASTM F 1083 "Specification

for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures."

1) Protective Coating: Complying with Type A – Zinc Coated, min. 2.0 oz./sq.ft, per ASTM A 123 "Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products," for exterior coating and interior coating after fabrication.
   a) Zinc Coated, min. 4.0 oz./sq.ft, per ASTM A 653 "Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) by the Hot-Dip Process" for rolled-form shapes.

b. Line, and Terminal (end, corner, pull and gate) Posts:
   1) 2-3/8 inch O.D. (2.375 inch O.D.) 3.65 pounds per lineal foot.
   2) 2-7/8 inch O.D. (2.875 inch O.D.) 5.79 pounds per lineal foot.
   3) 3-1/2 inch O.D. (3.50 inch O.D.) 7.58 pounds per lineal foot.
   4) 4 inch O.D. (4.00 inch O.D.) 9.12 pounds per lineal foot.
   5) 4-1/2 inch O.D. (4.50 inch O.D.) 10.80 pounds per lineal foot.
   6) 5-9/16 inch O.D. (5.563 inch O.D.) 14.63 pounds per lineal foot.
   7) 6-5/8 inch O.D. (6.625 inch O.D.) 18.99 pounds per lineal foot.
   8) 8-5/8 inch O.D. (8.625 inch O.D.) 28.58 pounds per lineal foot.

3. Rails:

a. General: All rails shall be round, seamless or continuously welded, steel pipe complying with ASTM F 1043 "Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework," Group IA, Table 3, Heavy Industrial Fence Framework, schedule 40 pipe per ASTM F 1083 "Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures."
   1) Protective Coating: Complying with Type A – Zinc Coated, min. 2.0 oz./sq.ft, per ASTM A 123 "Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products," for exterior coating and interior coating after fabrication.
      a) Zinc Coated, min. 4.0 oz./sq.ft, per ASTM A 653 "Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) by the Hot-Dip Process" for rolled-form shapes.

b. Top, Horizontal and Bottom Rails:
   1) 1-5/8 inch O.D. (1.625 inch O.D.) 2.27 pounds per lineal foot.

4. Tension Wire:

a. Metallic Coated Steel Wire: Seven gage (0.177 inch diameter), marcelled tension wire complying with ASTM A 824 "Specification for Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence."
b. Metallic Coating: ASTM A 817 "Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric and Marcelled Tension Wire," Type II Zinc-Coated, Class 5 – 2.0 oz./sq. ft., galvanized by hot-dip process.

5. Hook Bolts:

a. 3/8 inch diameter galvanized steel.

6. Tie Wires and Hog Rings:

a. Nine gage (0.148 inch diameter) galvanized steel wire, complying with ASTM F 626 "Specification for Fence Fittings." Galvanized minimum zinc coating of 1.2 oz/sq. ft.

7. Tension Bars:

a. 1/4 inch thick x 3/4 inch galvanized bar steel, complying with ASTM F 626 "Specification for Fence Fittings." Galvanized minimum zinc coating of 1.2 oz/sq. ft. by hot-dip process after fabrication.

8. Tension Bands:

a. 7/8 inch by 3/32 inch thick minimum galvanized band steel complying with ASTM F 626 "Specification for Fence Fittings." Galvanized minimum zinc coating of 1.2 oz/sq. ft. by hot-dip process after fabrication.

9. Truss Rod Assembly:

a. 3/8 inch diameter galvanized steel truss rod and galvanized turnbuckle for adjustment in compliance with ASTM F 626 "Specification for Fence Fittings." Galvanized minimum zinc coating of 1.2 oz/sq. ft. by hot-dip process after threading.
b. Assembly capable of withstanding a tension of 2,000 lbs.

10. Fittings:

a. General: In accordance with ASTM F 626 "Specification for Fence Fittings" and shall be hot-dip galvanized with a minimum of minimum of 1.2 oz/sq.ft., of zinc coating of surface area
b. Line and Terminal Post Caps: Fabricated from pressed steel or cast iron.
   1) Caps shall fit snugly over posts and exclude moisture from inside when tubular post are used.
   2) Provide Line Post Cap with loop to receive Tension Wire or Top Rail.

c. Rail and Brace Ends: Fabricated from pressed steel or round steel.
   1) Shall be provided when horizontal rail or brace are required.

d. Top Rail Sleeves: Fabricated from pressed steel or round steel.
   1) Rail sleeve material shall be a minimum of 0.051 inch in thickness and a minimum of 6 inches in length.
   2) Sleeve shall be fabricated to prevent movement along the rail.

e. Rail Clamps: Fabricated from galvanized pressed steel.
   1) Line and Corner Boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.

B. Gates:

1. General: All framing members shall be round, seamless or continuously welded, steel pipe complying with ASTM F 1043 "Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework," Group IA, Table 3 Heavy Industrial Fence Framework, schedule 40 pipe per ASTM F 1083 "Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures."

a. All frame corners (perimeter and interior) shall be of welded construction.

b. Frame members shall not be spaced no greater than 8 feet apart vertically and horizontally.

c. Protective Coating: Complying with Type A – Zinc Coated, min. 2.0 oz./sq.ft, per ASTM A 123 "Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products," for exterior coating and interior coating, galvanized after fabrication.

1) Zinc Coated, min. 4.0 oz./sq.ft, per ASTM A 653 "Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) by the Hot-Dip Process" for rolled-form shapes.

2) Weld joints shall be coated with zinc-rich paint in accordance with ASTM A 780 "Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings."

d. Fabric: Shall be the same as specified for the Fence.

e. Truss Rod Assembly: Shall be the same as specified for the Fence.

2. Swing Gates:

a. General: Gate fabrication shall comply with ASTM F 900 "Specification for Industrial and Commercial Swing Gates."

b. Frame: Galvanized.

1) 1-7/8 inch O.D. (1.875 inch O.D.) 2.72 pounds per lineal foot.

c. Hardware:

1) Hinges: Galvanized malleable iron or heavy gage pressed steel post and frame hinges.

2) Single Leaf Latch: Positive locking gate latch fabricated of 5/16 inch thick by 1-3/4 inch pressed steel, galvanized after fabrication and shall have provision for a padlock.

3) Double Leaf Latch: 5/8 inch diameter galvanized Drop rod arranged to engage the gate stop. Locking devised shall be constructed so the center drop rod cannot be raised when the gate is locked. Latching devices shall have provision for a padlock.

4) Gate Stop: Fabricated from 1 inch diameter galvanized steel pipe and 2 inch galvanized metal washer.

5) Keepers: Fabricated from galvanized malleable steel Gate Holdback and 1-5/8 inch diameter galvanized pipe with post cap.

6) ADA Gate Lock: Rust-proof aluminum/stainless steel lock assembly with latching mechanism, levers (both sides), key lock (lockable from both sides), keepers (latch or stop), post adapters, spacers, chain-link holders, tension bands and fittings as required.

a) Lock cores per Specification Section – HARDWARE.

7) Exit Door Gate: Galvanized exit door assembly with 16 gage x width as require steel plate, lock box, adjustable receiver bracket, guard and fittings as required.

a) Surface mounted Panic Bar per Specification Section – HARDWARE.

8) ADA Gate Kick-Plate:

9) 1/4 inch galvanized steel plate, minimum 10" high x width as required.

3. Rolling Gates:

a. General: Gate fabrication shall comply with ASTM F 1184 "Specification for Industrial and Commercial Slide Gates."

b. Frame:

1) 1-7/8 inch O.D. (1.875 inch O.D.) 2.72 pounds per lineal foot.

c. Pipe Track and Bracket:
   1) 1-5/8 inch O.D. (1.625 inch O.D.) 2.27 pounds per lineal foot.
      a) Galvanized Pipe Track Bracket and fittings as required.

d. Roller Assembly: Galvanized rear wheels, bolts, nuts, and bracket
e. Wheel Assembly: Double wheel carrier, galvanized with "U-Bolts" and eight (8) inch hard rubber wheels and fittings as required.
f. Steel AngleTrack: 1-1/2" x 1-1/2" x 1/8" galvanized steel with welded 3/8 inch diameter "J-Bolts" at 32 inches on center.
g. Guide Post: Galvanized.
   1) 2-7/8 inch O.D. (2.875 inch O.D.) 5.79 pounds per lineal feet.

C. Concrete:

1. Footings: Site Concrete as specified in Specification Section – CAST-IN-PLACE CONCRETE.
2. Non-shrink, Non-metallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107 "Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)." Provide grout, recommended in writing by manufacturer, for exterior applications.
3. Erosion-Resistant Anchoring Cement: Factor-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure with needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

D. Accessories:

1. Plastic Caps, sized to fit securely on fence wire fabric, as manufactured by STOCK CAP, or approved equivalent.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Layout:

1. Stake locations of fence lines, and terminal (end, corner, pull and gate) posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION

A. General: Construct and install chain-link fencing in compliance with ASTM F 567 "Practice for Installation of Chain-Link Fence" and more stringent requirements indicated.

B. Posts:

1. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
2. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

    a. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
    b. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
        1) Exposed Concrete Footing: Extend 2 inches above grade; shape and smooth to shed water.
        2) Concealed Concrete Footing: Stop 2 inches below bottom of material to allow covering top of footing.

3. Terminal Posts: Locate terminal end, corner, gate posts, and locate terminal pull posts at changes in horizontal or vertical alignment of 30 degrees or more, unless noted otherwise.

    a. End Corner, Pull and Gate Posts shall be braced and trussed for fabric 6 feet or higher, and for fabric 5 feet or higher at fencing without top rail.

4. Line Posts: Space line posts uniformly not to exceed 10 feet on center.

C. Rails:

1. Top Rail: Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal and gate posts, maintaining plumb position and alignment of fencing. Provide expansion couplings as recommended in writing by fencing manufacturer.

    a. Supply in lengths approximately 20 feet long and splice rail using top rail sleeves minimum 6 inches long.
    b. Secure rail to end, corner, pull and gate terminal posts with a brace band and rail end.

2. Brace Rail: Install brace rails between all end, corner, gate, and pull terminal posts and the first line posts, maintaining plumb position and alignment of fencing. Securely attach to post with fittings.

    a. Locate horizontal braces at mid-height of fabric greater than 72 inches in height, on fences with top rail and at two-third fabric height on fences without top rail.
        1) Spacing of brace rails not to exceed 6 feet on center vertically,

3. Horizontal Rail: Install horizontal rails between all line posts, maintaining plumb position and alignment of fencing. Securely attach to posts with fittings.

    a. Locate horizontal rails at mid-height of fabric 12 foot or higher,
        1) Spacing of horizontal rails not to exceed 12 feet on center vertically,

4. Bottom Rails: Install and secure to posts with fittings.

D. Truss Rod Assembly:

1. Diagonally brace all end, corner, pull and gate terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
2. Install so posts are plumb when diagonal rod is under proper tension.

E. Tension Wire:

1. Furnish and be responsible for accurate placement of Hook Bolts for installation in mow strip at mid-point between Line Posts.
2. Pull wire taut, without sags, independently and prior to the Fabric, between the terminal Posts and secured to the terminal Post using a brace band. Secure the tension wire to the chain link fabric with a hog rings a 18 inches on center and to each line post with a tie wire, maintain plumb position and alignment of fencing. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations

    a. Extended along bottom of fence fabric. Install bottom tension wire within 4 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
    b. Hook Tension Wire thru Hook Bolts.

F. Fabric:

1. Apply Fabric to outside of enclosing framework. Leave a maximum of 2 inches between finish grade or surface and bottom selvage, unless otherwise indicated. Pull Fabric taut and tie to Posts, Rails, and Tension Wires. Anchor to framework so fabric remains under tension after pulling force is released.

G. Tension or Stretcher Bars: Thread through Fabric and secure to end, corner, pull, and gate Posts with Tension Bands and 5/16 inch diameter carriage bolts at 12 inches on center maximum.

H. Tie Wire and Hog Rings: Use wire of proper length to firmly secure Fabric to line Posts, Rails, Truss Rod Assembly and Tension Wire per ASTM F 626 "Specification for Fence Fittings."

1. Fasten Fabric to Line Post with Tie Wire at 12 inches on center maximum.

    a. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric.
    b. Bend ends of wire to minimize hazard to individuals and clothing

2. Fasten Fabric to Rails (top, brace, horizontal and bottom) with Tie Wire at 18inches on center maximum.
3. Fasten Fabric to Tension Wire with Hog Rings, spaced a maximum of 18 inches on center.

I. Gates:

1. General: Installation of gates and gate posts in compliance with ASTM F 567 "Practice for Installation of Chain-Link Fence."
2. Gates shall be level, plumb and secure for full operation without interference.

    a. Attach fabric as for fencing.

b. Attach hardware using tamper-resistant or concealed means.
c. Furnish and be responsible for accurate placement of ground-set items in concrete mow strips.
d. Adjust hardware for smooth operation and lubricate where necessary

3. Swing Gates:

a. Gates have a bottom clearance of 3inch in the closed position, grade permitting.
b. Hinge and latch offset opening space from the gate frame to the post shall be no greater that 3 inches in the closed position.
c. Gate leaf holdbacks shall be installed for single gates 5 feet or greater in width and all double gates, unless noted otherwise.

4. Rolling Gates: Install gate according to manufacturer's written instructions, aligned and true to fence line and grade

a. Gates have a bottom clearance of 3inch in the closed position, grade permitting.

J. Fasteners:

1. All fasteners shall be installed with the smooth side on the secure side of the fence.

a. All bolts shall be peened over to prevent removal of the nut.

3.4 ADJUSTMENT

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.5 CLEAN UP

A. The area of the fence line shall be left neat and free of any debris caused by the installation of the fence.

END OF SECTION

SECTION 32 31 20 – AUTOMATIC SLIDING GATES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all automatic sliding gate materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
   1. DIVISION 00 SPECIFICATION SECTIONS.
   2. DIVISION 01 SPECIFICATION SECTIONS.
   3. 03 30 00 CAST-IN-PLACE CONCRETE
   4. 05 12 00 STEEL AND FABRICATIONS
   5. 09 91 00 PAINTING
   6. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
      a. ELECTRICAL SECTIONS
   7. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 SYSTEM DESCRIPTION

A. Design Requirements:
   1. In accordance with allowable values and properties assigned and approved by CBC.
   2. It is the intention of this section and the drawings to form a guide for a complete and operable system. Any items not specifically noted but necessary for a complete and operable system shall be provided under this section.

B. Performance Requirements:

   1. In accordance with allowable values and properties assigned and approved by CBC.
   2. It is the intention of this section and the drawings to form a guide for a complete and operable system. Any items not specifically noted but necessary for a complete and operable system shall be provided under this section.

1.3 REFERENCES

A. Underwriters Laboratories (UL): UL 325 – Standard for Safety for Door, Drapery, Gate, Louver, and Window Operators and Systems.

B. Canadian Standards Association (CSA): CSA C22.2 No. 247.

C. Underwriters Laboratories (UL): UL 991 – Standard for Tests for Safety Related Controls Employing Solid-State Devices.

D. American Society Testing Materials (ASTM): ASTM F2200 – Standard Specification for Automated Vehicular Gate Construction.

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E. National Electrical Manufacturers Association (NEMA): NEMA ICS 6 – Industrial Control Systems: Enclosures.

1.4 SUBMITTALS

A. General: Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

B. Format for Submittals: in accordance with Specification Sections – SUBMITTAL PROCEDURES, and FORMS AND REPORTS.

C. Coordination Drawings:
1. Submit installer's coordination drawings indicating the work of this section with that of related work of other sections for proper interface of the completed work. Installer shall coordinate and obtain approvals from the work of other related sections prior to submitting to the Architect.

D. Product Data:
1. Manufacturer’s descriptive literature and specifications.
2. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.

E. Shop Drawings.
1. Submit shop drawings showing fabrication and installation of automatic sliding gate operator systems, electrical cable, conduit, and devices required for connection of operators. Include the following:
    a. Dimensioned plans, elevations, and sections locating assembly components in relationship to contiguous gate elements.
        1) Dimensional location of loop detectors
    b. Typical and special fabrication and installation details, including details of anchorage to supporting structure.
    c. Motor Operator Information
        1) Single-line diagrams.
        2) Motor characteristic curves.
        3) Operation sequences.

F. Closeout Submittals in accordance with the following:
1. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
2. Operation Data in accordance with Specification Section - PROJECT CLOSEOUT.
3. Record Documents in accordance with Specification Section - RECORD DOCUMENTS.
4. Warranty in accordance with Specification Section - WARRANTIES.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications:

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a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
b. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's written warranty requirements.

2. Manufacturer/Supplier Qualifications:
a. Firm experienced in successfully supplying products similar to that indicated for this Project, with sufficient production/supply capacity to supply required units without causing delay in the work.

B. Meetings:
1. Pre-Installation:
2. Progress: Scheduled by the Contactor during the performance of the work.
a. Review for proper work progress.
b. Identify any problems and acceptable corrective measures.
c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contactor upon proper completion of the work.
a. Inspect and identify any problems.
b. Establish method and procedures to maintain protections while progressing to project completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:
1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:
1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
2. Damaged products will not be accepted.

C. Storage and protection:
1. Products shall be stored in a dry, protected area.

1.7 PROJECT CONDITIONS

A. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

1.8 WARRANTY

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A. Contractor's General Warranty:
   1. In accordance with Specification Section - WARRANTIES.

B. Special Warranties:
   1. Manufacturer's Warranty:
      a. In accordance with manufacturer's written standard warranty:
         1) Warranty Period Four (4) Years.
   2. Installer's Warranty:
      a. In accordance with the terms of the Specification Section - WARRANTIES, except the period of time shall be four (4) years.

1.9 OWNER'S INSTRUCTIONS

A. Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train the Owner's maintenance personnel.
   1. Test and adjust controls and any safeties. Replace damaged or malfunctioning controls and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products specified are from companies listed below, or approved equivalent. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers must still comply with the requirements of the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
   1. Specified product manufacturer:
      a. DOORKING, INC.
      b.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

2.2 GATE

A. Fabricate Gate from Galvanized Steel: Frame, 4" x 4" galvanized steel tube. Corner shall be reinforced. All connections shall be solidly welded and ground smooth, as specified in Section 05500 Metal Fabrications. Refer to Drawings for details as to the fabrication of the gates. The gates are to be bi-parting and connected to an automatic sliding gate operator and work in conjunction with each other. Finish the gates as scheduled on the drawings or as selected by the Architect.

B. Anchor Track Operation: Anchor track to concrete slab at not over 12" on center. Provide 5" solid steel V-groove wheels securely anchored to gate structure. Gate is to be secure and not

"wobble" in closed position. Provide brackets and stabilize as necessary per manufacturer's recommendations.

C. Materials: Refer to Section 05 50 00 STEEL AND FABRICATIONS for material requirements. All components to be galvanized and shop primed to receive paint finish. All surfaces shall be free from oil, dirt and imperfections.

2.3 SLIDING GATE OPERATORS

A. Operator: Equal to 9150 Commercial and Industrial Operator manufactured by Doorking, Inc., Provide 1 HP continuous-duty motor. Compliant with UL 325 and 991. Microprocessor based solid-state control board interacting with card readers, RF transmitters, access control systems, ticket machines, other activating devices as required, external devices (photo-eyes, contact edges) for entrapment protection and vehicle (loop) sensing systems. Control board shall include built-in close timer (1-25 seconds), built-in ports for two (2) plug-in loop detectors, partial open input, programming switches to set various operating modes, inherent magnetic pulse obstruction sensing reverse system. System shall employ Fail-Safe operation upon primary (AC) power outage.

1. Compliance: Compliant to UL 325, UL 991 and CSA C22.2 No. 247 and listed by Intertek Testing Laboratories NA, Inc. (ETL), a Nationally Recognized Testing Laboratory.
   a. This model is intended for use in Class I, II, III and IV vehicular slide gate applications.
2. Warranty: Five (5) year manufacturer's standard warranty.
3. Maximum Gate Length:
   a. 30-feet with 1/2 HP motor.
   b. 45-feet with 1 HP motor.
4. Maximum Gate Weight:
   a. 1000 Lbs. with 1/2 HP motor.
   b. 1500 Lbs. with 1 HP motor.
5. Operator speed: approximately 11-inches per second.
6. Enclosure:
   a. 12 gage, 0.108 inch (2.6 mm) G90 hot-dipped galvanized steel, finished with polyester powdercoat, exterior grade semi-gloss texture gray.
7. Configuration: Left or right hand mount; front, center or rear mounting configurations.
8. Mounting: Pad or post mount.
9. Electrical Power Requirements: 115/208/230/460/575 VAC.
   a. 208/230/460/575 VAC requires DoorKing High Voltage Kit.
10. Motor: Continuous Duty Motor.
    a. 1 HP
11. Dead Bolt Lock: Solenoid dead bolt engages if an attempt is made to force the gate open.
12. Fail-Safe Operation: Upon loss of primary (AC) power, system shall automatically be transferred to a fail-safe mode allowing the gate to be pushed open without the use of special knowledge, keys or other releasing mechanisms.

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13. Primary Reduction: Adjustable clutch, single cog belt drive train.
14. Pulling Medium: #40 roller chain
15. Magnetic Limit Switches: Automatic setting with no mechanical switches to set, wear out or break.
16. Operating Switches: Built-in power (on-off), reset and operating switches.
17. Convenience Outlets: Two (2) 115 VAC for accessory transformers.
18. Entrapment Protection
    a. Photo-electric eye (non-contact sensor).
    b. Sensing edge (contact sensor).
19. Accessories: Provide the optional accessories listed below.
    a. Thermostatically controlled heater kit.
    b. Base Plate – for post mount applications.
    c. Chain tray kit – to support roller chain on long gates.
    d. Fail-Secure Lock Kit – requires a key lock to open the gate upon primary (AC) power loss.
    e. Plug-in loop detectors.
    f. Electric reversing edge – reverses direction of gate on contact with an obstruction.
    g. Photo-electric beams – reverses direction of gate if the light beam is obstructed.
    h. Gate Tracker Expansion – provides time and date stamped electronic record of cycles, input errors, loop detector input errors, obstruction hits and power cycles.
        1) Requires companion DoorKing 1830 Series access controller.
    i. Backup power inverter – allows system to remain operation upon loss of primary (AC) power.

2.4 LOOP DETECTOR SYSTEM

A. Refer to Gate Component Schedule.

2.5 CONTROLS

A. Refer to Gate Component Schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:
    1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual that affects the execution of work under this specification section.

1. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
2. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:
1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:
1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

3.3 INSTALLATION

A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.

B. Layout:
1. Lines shall be straight and true.

C. Base: Install concrete pad and track support in accordance with Specification Section – CAST-IN-PLACE CONCRETE.

D. Installing Operators:
1. Secure operator mechanism to support in accordance with manufacturer’s instructions.
2. Lubricate hardware for smooth operation.
3. Adjust gate speed to specified feet per minute.

E. Controls: Mount key switches where indicated. Provide concealed conduit and connections.

3.4 ADJUSTING

A. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

3.5 CLEANING

A. Clean in accordance with Specification Section - TEMPORARY FACILITIES AND CONTROLS.

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1. Clean any soiled surfaces at the end of each day, minimum.
2. In accordance with manufacturer’s instructions and recommendations.

3.6 DEMONSTRATION

A. In accordance with Specification Section - PROJECT CLOSEOUT.
   1. As a condition of final acceptance, adjust moving parts and run gate through at least 10 cycles to demonstrate smooth operation.
   2. Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train Owner's maintenance personnel as specified below.
      a. Schedule training with the Owner's maintenance personnel with at least seven (7) days advance notice.
      b. Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance.
      c. Review data in "Operating and Maintenance Manuals". Refer to Specification Section - PROJECT CLOSEOUT.

END OF SECTION

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1.01 SCHEDULE

A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.

B. While the Gate Operator Component Schedule is a schedule intended to cover all operating gates, and establish type and standard of quality, the contractor is responsible for examining the Plans and Specifications and furnishing proper components, required for all automatic operating gates whether listed or not. If there are any omissions in hardware or components regarding the gates, they shall be called to the attention of the Architect prior to bid opening for instruction; otherwise, list will be considered Complete. No extras will be allowed for omissions.

C. The groups following will designate components for the appropriate gate and Head-End system.

D. The contractor and installer is to verify the quantity of entrapment devices in order to comply with UL325 and F2200.

E. The contractor is to confirm quantity of keytags and cards with the Owner.

Manufacturers Abbreviations (Mfr.)

DKS	=	Doorking	Gate Operator, Gate Security Entrapment Devices
EMX	=	EMX Industries	Photobeam Mounting Posts
LS2	=	LenelS2	Access control system Node and Blade add-on
IDT	=	Identiv	Card Readers, Cards/Keytags, Reader Mounting Posts

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COMPONENT GROUP NO. 01 – GATE SG01 – CHAIN LINK

QTY		DESCRIPTION	MODEL NUMBER	MFR
1	EA	GATE OPERATOR	9150-380	DKS
1	EA	HIGH VOLTAGE 1 PHASE – SURGE SUPPRESSOR (120VAC)	1879-080	DKS
1	EA	HEATER KIT (120VAC)	1601-154	DKS
1	EA	PLUG-IN SINGLE-CHANNEL DETECTOR	9410-010	DKS
4	EA	VEHICEL SENSING LOOPS	9401-06X	DKS
2	EA	CARD READER	8100ABP0000	IDT
TBD	EA	KEYTAGS/CARDS	4182/4110	IDT
2	EA	GOOSENECK POST	MP35	IDT
2	EA	READER MOUNTING BOX	MB5	IDT
2	EA	MOUNTING BRACKET KIT	TS2MBKIT	IDT
6	EA	PHOTOBEAM POST **COMPLIANT WITH UL325 & F2200**	PhotoeyeVault	EMX
6	EA	PHOTOBEAM	8080-060	DKS
3	EA	3-SIDED REVERSE EDGE	8080-066	DKS
3	EA	MONITORED EDGE TRANSMITTER	8080-006	DKS
1	EA	WIRELESS EDGE MONITOR/RECEIVER	8080-008	DKS

COMPONENT GROUP NO. 02 – HEAD-END- ACCESS CONTROLLER SYSTEM

QTY		DESCRIPTION	MODEL NUMBER	MFR
1	EA	NETWORK NODE IN WALL MOUNT ENCLOSURE	S2-NN-E2R-WM	LS2
1	EA	ACCESS CONTROL APPLICATION BLADE	S2-ACM	LS2

END OF SECTION

SECTION 328400 - IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all materials, labor, equipment and services necessary to furnish, install and maintain the Irrigation System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.

B. Related Work Specified Elsewhere
   1. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 1 Specification Sections, apply to work of this section.
   2. Section 31 20 00 – Earthwork
   3. Section 31 23 00 – Trench Excavation and Backfilling
   4. Section 32 90 00 – Landscape Planting

1.02 CODES AND REGULATIONS

A. All work and materials shall be in full accordance with the following codes adopted and amended by the authority having jurisdiction. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. The work described in these specifications shall govern in the event that the drawings or specifications call for material or methods of construction of higher quality or standard than required by these codes.
   1. California Plumbing Code
   2. California Administrative Codes:
      a. Title 8, Industrial Relations
      b. Title 19, Public Safety
   3. California Electrical Code
   4. California Green Building Standards Code, Section 5.304.
   5. California Department of Water Resources, Model Water Efficient Landscape Ordinance (MWELO)
   6. Standards and Regulations of other agencies, water utility provider, or organizations as listed in this specification relating to products or procedures, e.g. American Society for Testing and Materials.

1.03 DEFINITIONS

A. Piping: All pipe fittings, valves, and accessories as required for a complete piping system.

B. PVC: Polyvinyl Chloride.

C. Agencies and Organizations:
   1. ASTM- American Society for Testing and Materials
   2. AWWA- American Water Works Association
   3. IAPMO- International Association of Plumbing and Mechanical Officials
   4. CEC - California Electrical Code.
   5. UL - Underwriter's Laboratories
   6. SSPWC – Standard Specifications for Public Works Construction, by the American Public Works Assoc./Associated General Contractors of California.

D. Owner: An authorized representative of the Owner or the Owner's authorized consultant.

1.04 QUALITY ASSURANCE

A. The work of this section shall be performed by a single firm experienced in irrigation work and holding a current California Contractor's A or C27 License.

B. Qualifications of Workers
   1. The Contractor shall employ skilled workers who are thoroughly trained and experienced in irrigation system installation and who are completely familiar with the specified requirements and methods needed for proper performance of this work.
   2. The Contractor shall provide adequate supervision by a qualified foreman fluent in English that will be continuously onsite during the performance of this work.

1.05 SUBMITTALS

A. An operational assessment report of any existing irrigation system in the area of work shall be submitted prior to the start of the project's work, including demolition and clearing. See Subsection 1.07.

B. The Contractor shall submit complete lists of proposed materials and equipment per the Division 01 Submittal Section, including manufacturer's name and model numbers. Only provide additional product data and/or catalog cut sheets if a substitute material or equipment is proposed. No substitution will be allowed without prior written approval.

C. Shop drawings shall be provided for the layout and description of all equipment assemblies, including dimensions, capacities, and other characteristics as listed in product specifications. Shop drawings for booster pump assemblies shall clearly and neatly indicate the layout of the assemblies and proposed piping in the pump yard, and shall show adjacent equipment, required clearances, walls, fences, piping and other existing permanent improvements affecting the layout. Materials and equipment shall not be ordered until given written acceptance. Equipment or materials installed or furnished without prior approval or acceptance may be rejected and the Contractor shall be required to remove such materials from the site at his own expense.

D. When specific name brands of equipment and materials are used, they are intended as preferred standards only. This does not imply any right upon the part of the Contractor to furnish other materials unless specifically approved in writing as equal in quality and performance by the Owner. Decisions by the Architect/Engineer shall govern as to what name brands of equipment and materials are equal to those specified on the plans and his decisions shall be final. It shall be the responsibility of the Contractor to furnish proof as to equality of any proposed equipment or material.

E. Approval of any item, alternate or substitute indicates only that the products apparently meet the requirements of the drawings and specifications on the basis of the information or samples submitted. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

F. Acceptance of any submittals, deliverables, or other work product of the Contractor shall not be construed as assent that the Contractor has complied with, nor in any way relieved the

Contractor of compliance with (i) the applicable standard of care, and/or (ii) applicable statutes, regulations, rules, guidelines, and contract requirements.

G. Irrigation Equipment: When the Contractor desires to transfer salvaged irrigation equipment and/or new spare equipment and/or parts to the Owner, he must submit along with the equipment an itemized list. The Contractor is solely responsible to obtain a written confirmation by the Owner that all materials received by the Owner matches his material list. The transfer of materials will not be considered executed without written confirmation of same.

H. Submit any required or requested testing data and/or Certificates, including but not limited to the backflow prevention assembly testing Certificate after the assembly is installed prior to regular system operation.

1.06 EXPLANATION OF DRAWINGS

A. The intent of the drawings and specifications is to indicate and specify a complete and efficient sprinkler irrigation system ready for use in accordance with the manufacturer's recommendations, and all applicable local codes and ordinances. Interpretation of irrigation plans and specifications shall be the responsibility of the Landscape Architect or Owner.

B. All existing systems and improvements are shown in their approximate locations. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and shall report any variations to the Owner.

C. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, etc., which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all his work, and plan his work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner, so that conflicts between sprinkler systems, planting, utilities, and architectural features will be avoided. Locate pipe, valves and other equipment in planting areas unless specifically noted otherwise.

D. All work called for on the drawings by notes shall be furnished and installed whether or not specifically mentioned in the specifications.

1.07 EXISTING CONDITIONS

A. The Contractor shall not install the irrigation system and equipment as shown on the Drawings when it is obvious in the field that obstructions or differences in existing conditions and/or systems are present. Such obstructions or differences should be immediately brought to the attention of the Owner. Failure to provide notification prior to the start of this work shall make the Contractor liable for any and all repairs and/or corrections necessary for proper functioning and coverage of the system without any additional cost to the Owner.

B. The Contractor shall examine carefully the site of work contemplated and the proposal, plans, specifications, and all other contract documents. By submitting a bid, the Contractor attests that he has investigated and is satisfied as to the conditions to be encountered, as to the character, quality, and quantity of work to be performed and materials to be furnished, and

the requirements of the specifications. The Contractor shall take necessary precautions to protect existing site conditions that are to remain. Should damage be incurred, the Contractor shall make the necessary repair or replacement to bring it back to its original condition at his own expense.

C. Prior to cutting into the soil, the Contractor shall coordinate with the Owner to locate all cables, conduits, sewers, septic tanks, and other such underground utilities as are commonly encountered and he shall take proper precaution not to damage or disturb such improvements. If a conflict exists between such obstacles, notify the Owner who will consider realignment of the proposed work. The Contractor will proceed in the same manner if a rock layer or any other condition encountered underground makes change advisable. Should utilities not shown on the plans be found during excavations, Contractor shall promptly notify the Owner for instructions as to further action. Failure to do so will make Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities not shown in plans.

D. The Contractor shall verify the correctness of all finish grades within the work area in order to insure the proper soil coverage (as specified) of the sprinkler system pipes. The Contractor shall verify and be familiar with location and size of the proposed water supply (P.O.C.). He shall make approved type connection and install new work.

E. The Contractor shall be responsible for notifying the Owner prior to installation that equipment or methods indicated on the drawings or in the specifications conflict with local codes, are incompatible or an error is apparent. It the event the Contractor neglects to do this, he will accept full responsibility for any revisions necessary.

1.08 PERMITS

A. The Contractor shall obtain and pay required fees to any governmental or public agency. Any permits for the installation or construction of any of the work included under this contract, which are required by any of the legally constituted authorities having jurisdiction, shall be obtained and paid for by the Contractor, each at the proper time. He shall also arrange for and pay all costs in connection with any inspections and examination required by these authorities.

1.09 TESTING

A. General: Unless otherwise directed, tests shall be witnessed by the Owner. Work to be concealed shall not be covered until prescribed tests are made. Should any work be covered before such tests, the Contractor shall, at his expense, uncover, test and repair his work and that of other contractors to original conditions. Leaks and defects shown by tests shall be repaired and entire work re-tested. Tests may be made in sections, however, all connections between sections previously tested and new section must be included in the test.

B. Main Line Piping: Hydrostatical test main line pipe segments after a minimum of twenty-four (24) hours after any solvent connections. Purge any free air in the test pipe sections. Partially backfill pipe but keep all joints exposed. Maintain 125 psi water pressure in new main line piping for a minimum duration of two (2) hours. There can be a maximum +/- 5psi change in pressure during the test.

C. After being installed at the project site, any newly installed Backflow Prevention unit must be tested and approved as functioning properly per the local water agency requirements. Approval of the backflow prevention unit must precede any final inspection of the irrigation system. All costs for testing shall be the responsibility of the Contractor.

1.10 OBSERVATION

A. General:
   1. Installation and operations must be approved by the Owner.
   2. In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval of the Owner. Any work covered prior to inspection shall be opened to view by the Contractor at his expense.
   3. In all cases, where inspection of the irrigation system work is required and/or where portions of the work are specified to be performed under the direction and/or inspection of the Owner's Representative, the Contractor shall notify the Owner's Representative at least 48 hours in advance of the time when such inspection and/or direction is required. Any necessary re-excavation or alterations to the system needed because of failure of the Contractor to have the required inspection, shall be performed at the Contractor's own expense.

B. Periodic observations shall be required for basic operations and installations during progression of the project. The Owner's Representative, Owner or Landscape Architect shall perform the observations and shall record the observation on the Irrigation System Observation Log form on the As Built Record Drawings. Such observations will include but not necessarily be limited to the following items as included in the scope of work:
   1. Layout and flagging of sprinkler heads.
   2. Trenching.
   3. Main line installation.
   4. Main line sustained pressure check.
   5. Wire placement.
   6. Partial fill compaction of trenches.
   7. Control valve installation.
   8. Drip line installation prior to backfilling.
   9. Sprinkler/emitter coverage prior to the start of planting operations.
   10. Overall system operation and primary/secondary communication.

C. Coverage & Operations Review:
   1. When the irrigation system is operational and prior to soil conditioning operations, the Contractor in the presence of the Owner shall perform a coverage test of the irrigation system. The Contractor shall furnish all materials and labor required to perform the coverage test and to correct any minor inadequacies of coverage disclosed. The Contractor shall inform the Owner and Owner of any deviation from the plan required due to wind, planting, soil, or site conditions that bear on proper coverage. If such notification of necessary corrections or additions to the irrigation system is not provided prior to or during the coverage test, the Contractor shall make all subsequent adjustments and corrections needed for proper coverage without any extra cost to the Owner.
   2. Prior to the start of the maintenance period, the irrigation system shall be reviewed by the Owner for proper operations, and a review of and training on equipment and

associated controls performed. Any corrections and/or adjustment shall be made as a condition for the start of the maintenance period and subsequent Final Acceptance.

D. Final Acceptance: The work will be accepted in writing when the entire project improvements have been completed to the satisfaction of the Owner. In judging the work, no allowance for deviation from the original plans and specifications will be made unless already approved in writing at proper time. Should it become necessary for the Owner to occupy any portion of the work area before the contract is fully completed, such occupancy shall not constitute acceptance. The Contractor will not be responsible for any damage caused by the Owner's separate work forces.

1.11 REJECTION OF NON-CONFORMING MATERIAL OR WORK

A. The Owner reserves the right to reject any material or work which does not conform to the contract documents. The rejected material or work shall be removed or corrected by the Contractor at no additional cost to the Owner.

1.12 OPERATIONS AND MAINTENANCE INSTRUCTIONS & RECORD DOCUMENTS

A. The Contractor shall prepare and deliver to the Owner’s Representative within ten (10) calendar days prior to completion of the maintenance period, all required and necessary descriptive material in complete detail and sufficient quantity, properly prepared in two individually bound sets of Operating and Maintenance Manuals. These manuals shall describe the material installed and shall be in sufficient depth to permit operating personnel to understand, operate and maintain all equipment. Spare part lists and related manufacturer identification shall be included for each installed equipment item. Each complete, bound manual shall contain the following information:
   1. Cover sheet stating Contractor's address and telephone number, duration of guarantee period, and a list of equipment, with names and addresses of local manufacturer representatives and warranty periods.
   2. The Contractor to issue a "CERTIFICATE OF CONSTRUCTION COMPLIANCE" which indicates that all work done, materials and equipment used and installed are in compliance with the approved plans, specifications and all authorized revisions and that the system functions properly.
   3. Complete operating and maintenance instructions and warranties on all major equipment.
   4. Complete set of manufacturer's literature and specifications of material installed, including parts list.
   5. A list of the controller station number for each control valve if different than the control valve number shown on the drawings.
   6. Initial electrical data on each control valve:
      a. Ohms reading for each valve taken at the controller (circuit is OFF).
      b. Voltage reading for each valve taken both at the controller and at the valve (circuit is ON).

B. The contractor shall furnish one set of As-Built full-scale drawings on bond, and two compact disks with complete sets of digital PDF files of all close-out documents after the As-Built Record Drawings have been reviewed and accepted by the Landscape Architect.
   1. Label first page of each document, or set of documents, "AS-BUILT PROJECT RECORD" in neat large printed letters on lower right hand corner. Record information

concurrently with construction progress. Prints for this purpose may be obtained from the Owner. This set of drawings shall be kept on the site and shall be used only as a record set. Do not conceal any work until required information is recorded. These drawings shall also serve as work in progress sheets, and the Contractor shall make **neat and legible** annotations thereon daily as the work progresses, showing the work as actually installed. These drawings shall be available at all times for inspection and shall be kept in a location designated by the Owner.

2. Drawings: Legibly mark to record actual construction:
   a. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Give sufficient horizontal and vertical dimensions to accurately trace route and depth of each concealed line or item. Accurately locate each capped, plugged or stubbed line.
   b. Field changes of dimension and detail.
   c. Changes made by Field Order, Addenda, or other change document.
   d. Show the final controller station number for each control valve if different than the control valve number shown on the drawings.
3. Deliver all Close-out Documents (As-Builts) to the Owner. Accompany submittal with transmittal letter in duplicate, containing:
   a. Date.
   b. Project title.
   c. Contractor's name and address.
   d. Title and number of each Record Document (As-Built).
   e. Signature of Contractor or his authorized representative.

C. The Contractor shall provide controller chart(s) as follows:
   1. The Contractor shall provide two controller charts for each controller’s area of work.
   2. The chart shall show the area of work controlled by the automatic controller and shall be the maximum size that the controller door will allow.
   3. Show the controller station number for each control valve if different than the control valve number shown on the drawings.
   4. The chart may be a reduced drawing of the actual as-built system. However, in the event the valve numbering is not legible when the drawing is reduced, it shall be enlarged to a size that will be readable when reduced.
   5. The chart shall be colored with a different permanent color for each station.
   6. The chart shall be enclosed in a waterproof envelope or laminated.

D. Per MWELO Section 492.9, upon completion of the landscape planting and irrigation system, and as a condition of Final Acceptance and/or the issuance of a Certificate of Occupancy, the licensed landscape contractor shall submit to the approving agency and/or Owner, the following items in a form acceptable to the approving agency and/or Owner:
   1. Project information and contact information for the Owner and Applicant (Contractor).
   2. Certification that the installation complies with the approved Landscape Documentation Package.
   3. Irrigation scheduling parameters used in programming the controller during the establishment and maintenance periods.
   4. A Schedule of Irrigation System Maintenance.
   5. A Landscape Irrigation Audit Report per MWELO Section 492.12. Provide the Audit Report unless the report is not required by the approving agency or Owner.

1.13 SPARE PARTS AND EQUIPMENT

A. Prior to the conclusion of the maintenance period, furnish the Owner with the following spare parts and equipment:
   1. One quick coupler key with attached hose swivel for each set of four quick coupler valves installed.
   2. Ten spare nozzles for each different sprinkler head arc and/or radius nozzle installed.
   3. One valve key for the 2” operating nut and/or hand wheel isolation valve.
   4. One hundred feet of in-line emitter tubing with ten straight and ten ninety degree compression fittings.

1.14 WORK AREA AND SAFETY

A. The Contractor shall furnish, erect, and maintain all temporary facilities; perform all temporary work during the period of construction, including those herein specified. All facilities shall be maintained in proper and safe operating and sanitary conditions at all times.

B. The Contractor shall comply with the provisions of the Construction Safety Orders, and General Safety Orders issued by the State Division of Industrial Safety, as well as all other applicable laws, ordinances and regulations.

C. The project site shall be maintained in a neat and safe condition at all times. Cleanup shall be accomplished as the work progresses and upon completion of the work. The Contractor shall provide adequate safety measures to protect workers and the public from injury.

1.15 GUARANTEE

A. Irrigation system consisting of materials, equipment and workmanship shall be guaranteed for proper operation a minimum of one year from date of Final Acceptance of the Work or the Notice of Substantial Completion of the Project, whichever is later. Manufacturer’s warranty periods may be longer, and shall be noted in the close-out documents.

B. The Contractor shall be held responsible for repair and/or replacement of damages to new or existing improvements resulting from the defects of materials, equipment or workmanship one year from the date of Final Acceptance of the Work or the Notice of Substantial Completion of the Project, whichever is later.

C. The Owner reserves the right to make temporary repairs as necessary to keep the irrigation system equipment in operating condition. The exercise of this right by the Owner shall not relieve the Contractor of his responsibilities under the terms of the Guarantee as herein specified.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

A. Schedule rated white rigid PVC Pipe shall be made from NSF approved Type 1, Grade I, PVC compound conforming to ASTM D-1785.

B. Class rated (Standard Dimension Ratio) white rigid PVC Pipe shall be made from NSF approved Type 1, Grade I, PVC compound conforming to ASTM D-1784.

C. PVC pipe shall be of the Class or Schedule as follows:
   1. PVC pipe shall meet ASTM D-2241 for solvent weld, plain end, ASTM D-2672 for solvent weld, bell end, and ASTM D-3139 for gasketed bell end. Pipe shall be of the Schedule and/or Class as indicated herein.
   2. Pipe sleeves under paving shall be PVC Schedule 40 for 3-inch and smaller or SDR 35 for 4-inch and larger pipes.
   3. Riser and/or manifold pipe connecting valves to main line fittings shall be Schedule 80 PVC.
   4. Pressurized main line pipe shall be Schedule 40, belled end with solvent welds for pipe sizes less than 2 inches. Pipe sized 2 inches and greater shall be Class 200, SDR 21, with gasketed bell ends.
   5. Non-pressurized lateral line pipe shall be Schedule 40, belled end with solvent welds.

D. All pipes shall be continuously and permanently marked and conform with the following information: manufacturer's name or trademark, nominal pipe size, Schedule or Class of pipe, pressure rating in PSI, ASTM designation and (NSF) seal of approval.

E. Rigid polyvinyl chloride (PVC) Fittings:
   1. White Schedule 40 type I and II grade 1, solvent weld socket fittings ASTM D-2466 for all lateral lines 2-1/2 inches and smaller.
   2. Gray Schedule 80 type I and II grade 1 solvent weld socket fittings ASTM D-2464 for all main line less than 2 inches diameter, and lateral lines 3 inches and larger.
   3. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable (IPS) schedule, and (NSF) seal of approval.
   4. All plastic fittings and connectors shall be injection molded of an improved polyvinyl chloride compound featuring high tensile strength, high chemical resistance and high impact strength in terms of current ASTM standards for such fittings. Where threads are required in plastic fittings, these shall be injection molded also.

F. PVC Solvent Weld Adhesive: All socket and bell type connections shall be joined with primer and PVC solvent cement which shall meet the requirements of ASTM F656 for primer and ASTM D2564, "Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings." Solvent cement joints for plastic pipe and fittings will be made as prescribed by manufacturer. The high chemical resistance of the pipe and fitting compounds specified in the foregoing sections makes it mandatory that an aggressive colored primer, which is a true solvent for PVC be used in conjunction with a solvent cement designed for the fit of pipe and fittings specified. A heavy bodied, medium set solvent cement, e.g. Weld-On 711 gray, shall be used for all classes and schedules of pipe and fittings.

G. PVC Pipe Thread Sealant: A non-hardening all purpose sealant and lubricant similar to Permatex #51 or Lasco blue pipe thread sealant which is certified by the manufacturer to be harmless to PVC pipe and fittings. Apply sealant to clean male threads, brushing into grooves and to the first three threads of the female threads. A good quality grade of teflon tape recommended by the manufacturer for use with plastics may be used in lieu of sealant. Minimum width of tape to be used is 3/4". A minimum of two wraps and a maximum of three wraps shall be used.

H. PVC Swing Joints: Connections to sprinkler heads from lateral lines shall be made with swing joints as detailed. Pre-assembled swing joints from Hunter, King Brothers or Spears are acceptable.
   1. Use 6” length nipples for 1/2 inch inlet heads.
   2. Use 12” length nipples for 3/4 or 1 inch inlet heads.

I. Coated Ductile Iron pipe and fittings:
   1. Ductile Iron pipe shall be centrifugally cast pipe conforming to ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, thickness Class 50, with cement - mortar lining and seal coating per ANSI/AWWA C104/A21.4.
   2. Ductile Iron flanged pipe shall conform to ANSI/AWWA C115/21.15.
   3. Ductile Iron flanged fitting to PVC pipe shall use a ‘Megalug’ mechanical joint restraint Series 2000PV by EBAA Iron per either ANSI/AWWA C111/A21.11 or ANSI/AWWA C153/A21.53, or equal.
   4. Joints shall comply with the following standards:
      a. Rubber gasketed/mechanical joints: ANSI/AWWA C111/A21.11.
      b. Flanged joints: ANSI/AWWA C110/A21.10, B16.1, B16.2.

J. Coated ductile iron push-on fittings meeting ANSI/AWWA C110 or C153/A21.10 shall be used for:
   1. Main line connections for pipe 2 inches and greater in diameter.
   2. New main line service tee at valve connections where a service saddle is not acceptable.
   3. Self-restrainted fittings or joint restraints (Leemco LH or equal) shall be used for all elbows, tees, bends, etc fittings.

K. Coated ductile iron service saddles with stainless steel double straps, Smith-Blair 317, Romac Industries 202NS, or equal, shall be used for remote control/quick coupler valve service connections on main lines 1.25 inch or greater, and where the available outlet size can match the largest lateral line size downstream of the remote control valve.

L. Galvanized pipe and fittings:
   1. Galvanized Pipe shall be hot dip galvanized continuous welded, seamless steel SCH 40 pipe conforming to current ASTM A53 standards.
   2. Galvanized Fittings shall be galvanized, threaded malleable iron SCH 40 conforming to current ASTM A865 standards.

2.02 BACKFLOW PREVENTION ASSEMBLY

A. The backflow prevention assembly is existing and shall remain in place.

2.03 VALVES

A. Electric Control Valves:
   1. Globe valves operated by low-power solenoid, normally closed, manual flow adjustment. Sizes and types as shown on drawings.
   2. Provide a pressure regulating module on all control valves, or other pressure regulating components as part of the operating spray head or low volume head zones when the dynamic system pressure is, or may be greater than 45 psi.

B. Control Valve Marking: Christy's valve identification tag (or equal), yellow color (purple color for recycled water) with text designating controller and valve station number, e.g. "A12", or equivalent.

C. Isolation Valves:
1. Cast bronze, coated ductile iron or coated cast iron gate valve with resilient wedge, non-rising stem and two inch operating nut for main line 2 inch size or greater. Match size of mainline.
2. Cast bronze threaded gate valve with bronze cross handle for main line less than 2 inch size.

D. Quick Coupling Valve: Two piece quick coupling valve as shown on the Drawings.

2.04 VALVE BOXES

A. Control Valve/Master Valve/Flow Sensor boxes:
1. Shrub/Ground Cover areas: Carson 1419 body with lockable tan plastic cover, or equivalent. Drip Valve Kits shall use a Jumbo body with lockable tan plastic cover.
2. Turfgrass areas: Carson 1419 body with lockable green plastic cover, or equivalent.
3. Hardscape areas: Christy B16 concrete box (11.75" x 22.25") with N16R composite solid flush lid, or equivalent.

B. Quick Coupler Valve boxes:
1. Shrub/Ground Cover areas: Carson 910 body with lockable tan plastic cover, or equivalent.
2. Turfgrass area: Carson 910 body with lockable green plastic cover, or equivalent.
~~3. Skinned ballfield areas: Christy F08 round concrete valve box (8" ID) with F08R concrete lid, or equivalent. Boxes in a sports venue's field of play that are noted to be installed below grade shall use a metal lid with a non-woven geotextile of a minimum 0.5 lb./sq. yd. covering the lid and box frame.~~

C. Isolation Valve boxes:
1. Gate Valve box in hardscape: Christy G05 round concrete valve box (10.375" ID) with cast iron G05C lid, or equivalent.
2. Gate Valve box in planting areas: Christy F08 round concrete valve box (8" ID) with F08R concrete lid, or equivalent. Use F14 ADS adapter and extension for sizes 2.5 inches and larger.
3. Ball Valve box: Same as 2.04, A.

D. Control Valve box marking: Plastic lids shall have branded markings, and concrete lids shall have painted markings on the top of lid with minimum 2 inch high stenciled letters showing controller letter and station number.

2.05 CONTROLLER

A. The irrigation Controller is existing and shall remain in place~~ / shall be relocated~~. Verify open stations and spare wire, if any, in the area of work.

2.06 CONTROL AND TRACER WIRE, COMMUNICATION CABLE

A. Connections between the automatic controllers and the electric control valves, and tracer wire shall be made with direct burial AWG – UF 600 volt copper wire manufactured for irrigation system use.

B. Hot control wires for the first controller shall be red. If multiple controllers are installed, the hot wire color shall be orange, yellow, purple in order for each controller. Common ground wire shall be white, with a color stripe corresponding to the hot control wire color when multiple controllers are installed. Spare control wires shall be black and spare common wire blue. Tracer wire shall be green.

C. Install in accordance with valve manufacturer's specifications and wire chart. In no case shall wire size be less than #14. Common wire shall be a minimum #12 size.

D. All control wire splices/caps shall be made with direct bury rated, waterproof wire connectors with silicone sealant, Spears DS-500 Dri-Splice, 3M DBR/DBY or approved equal. Use one splice per connector sealing pack.

E. Apply waterproof numbered wire markers or sleeves at both sides of all splices and at the controller terminal board corresponding to the controller (A, B, etc.) and station number (02, 14, etc.). If multiple valves are connected to one station, add a single digit indentifier (1, 2, etc.) to the station number (XX), e.g. A02-1, A02-2, etc.

F. Communication/flow sensor cable shall be a shielded and jacketed, minimum 16 gauge twisted pair with drain wire, Paige P7162D or equal compliant with the controller manufacturer's specifications.

G. Below-grade conduit for control wires and/or cables shall be PVC for electrical use with long radius sweeps at direction changes and at valve/splice/pull box terminations.

2.07 IRRIGATION HEADS

A. Spray/Bubbler Pop-up Head: Molded plastic body with pop-up plastic riser and nozzle. Manufacturer's model numbers are listed with description on the Drawings.

B. Rotor Pop-up Head: Molded plastic body with plastic riser and nozzle, Gear driven rotation with memory arc, balanced nozzle sets. Manufacturer's model numbers are listed with description on the Drawings.

2.08 DRIP IRRIGATION EQUIPMENT

A. Flexible distribution tubing shall be 0.66" – 0.70" OD (17mm nominal) fabricated from virgin polyethylene resin specifically designed for subsurface drip irrigation use and conforming to ASTM D 1248 for Type I, Class C, Category 4 Grade P14, and to ASTM D-3350 for PE 122111C. Provide all fittings, connectors and accessories compliant with the tubing for a complete, properly functioning system.

B. Pressure rating of tubing shall be as defined in Standard ASAE S435. Burst strength shall be minimum 50 psi at 176 degrees F for 4,200 hours.

C. In-line wye filters shall be type as noted on the Drawings. Filter element shall be molded polyester screen cylinder with minimum 150 mesh screen (blue).

D. Preset pressure regulators shall be type as noted on the Drawings for above or below ground application.

E. In-line emitter tubing shall be a below grade product with self-cleaning emitters. Manufacturer as noted on the Drawings.

F. Flush valve assembly shall be as noted on the Drawings.

G. Operation indicator shall be a 6 inch pop-up sprinkler body with built-in check valve. Install a bubbler or variable arc nozzle that can be adjusted to a no-flow condition, Hunter ECO-INDICATOR, or equal.

2.09 CONCRETE

A. Cast-in-place Portland cement concrete used for pipe encasement, cover, thrust blocks, pipe support or other below-grade use shall at minimum comply with 2,800 psi 28 day strength.

2.10 OTHER MATERIALS

A. Materials not specifically indicated but necessary for the proper execution of this work shall be of first quality as selected by the Contractor subject to the acceptance of the Owner.

B. All materials appearing in the legend and details of the irrigation drawings are to be furnished and installed by the Contractor unless specifically noted to the contrary. Contractor is responsible for installation according to plans and details. The system shall efficiently and uniformly irrigate all areas and perform as required by these plans and specifications.

C. Granular bedding material shall be clean natural occurring sand, free from clay, salt, sea shells or organic material, suitable for the purpose intended, and shall be of such size that 90 percent to 100 percent will pass a No. 4 sieve and not more than 5 percent will pass a No. 200 sieve.

PART 3 - EXECUTION

3.01 SYSTEM DESIGN AND VERIFICATION

A. Contractor shall verify existing pressure and any existing irrigation equipment, and shall inform the Owner of any discrepancies between the exsiting systems' make and model of equipment, such as sprinkler heads, control valves, etc., and those indicated in the Drawings in writing prior to the start of irrigation system installation. Failure to inform the Owner of any discrepancy within seven working days prior to beginning of system installation will place the responsibility of any and all corrective action on the Contractor at no expense to the Owner.

3.02 PIPING INSTALLATION

A. General:

1. Any equipment installed by the Contractor and deemed to be for the use of the Owner in various situations (i.e., control valves, control panels, etc.) shall be so installed to be readily accessible and quickly operable. Equipment deemed by the Owner to be inoperable for its intended purpose shall be reinstalled by the Contractor in an operable position before approval will be given. Any changes made by the Contractor shall be done without any additional cost to the Owner.
2. The Contractor shall be responsible for layout of proposed facilities and any minor adjustments required due to differences between existing conditions and the Drawings. Any such deviations in layout shall be within the intent of the original drawings, and without additional costs to the Owner. The Owner will indicate the proposed precise location of the control panels. Head spacing on drawings is diagrammatic. Head spacing and patterns shall be adjusted to provide complete and adequate coverage with a minimum spray on non-planted areas. Where head spacing is not specifically noted, Contractor shall install sprinkler heads evenly along the irrigation area's perimeter. Flush all lines prior to installation of heads.
3. Support piping without strain on joints or fittings and allow for piping expansion and contraction. "Snake" pipe into trench in accordance to manufacturer's recommendations to allow for expansion. Lay on solid bedding, at uniform depth.

B. The Contractor shall examine all other portions of working drawings and plan trenching and pipe layout so that no conflict will arise between irrigation and any other work. Any corrective action will be the Contractors responsibility at no further expense to the Owner.

C. Excavations:
1. Excavations shall be open vertical construction, sufficiently wide to provide clear working space around the work installed and to provide ample space for backfilling and tamping.
2. The use of a vibratory plow or methods other than open vertical trenching will not be allowed without the written approval of the Owner. To obtain such approval, a field test must be performed, at the proposed site, with the equipment to be used in the presence of the Owner and Owner. The field test is to indicate if the proposed site is favorable to the plowing method. Approval for plowing at one location does not allow the use of plowing at another location. Approval for plowing must be obtained for each location where the use of plowing is proposed. If, at previously approved plowing locations, conditions for plowing become unfavorable as determined by the Owner, plowing shall be terminated.
3. Trenches for pipe and equipment shall be cut to required grade lines, and compacted to provide an accurate grade and uniform bearing for the full length of the line.
4. Unless written approval for using native soils as bedding material is given by the Owner, main line pipe shall be placed on a minimum 6 inch depth of granular bedding material.
5. Excess trench soil with rocks greater than ½ inch diameter shall be removed from the planted area and spread as directed by the Owner.
6. When two pipes/conduit are to be placed in the same trench, it is required to maintain a minimum six inch (6") horizontal separation between pipes/conduit.
7. Depth of trenches shall be sufficient to provide a minimum cover above the top of the pipe as follows:
   a. 24-inch minimum over main lines and wire conduit.
   b. 18-inch minimum over non-pressure (rotary pop-up) lateral lines.
   c. 12-inch minimum over non-pressure (pop-up spray head) lateral lines.
   d. 24-inch minimum from subgrade over any lines located in a paved vehicle area.

e. Maximum cover above the top of the pipe shall not exceed twelve inches (12”) greater than the required minimum cover.
f. 12-inch minimum cover over drip line non-pressure lateral and manifold pipe, and main distribution tubing.

D. Assemblies:
1. Routing of pressure supply lines as indicated on drawings is diagrammatic. Install lines (and various assemblies) in such a manner as to conform with details on plans.
2. Install all assemblies specified herein according to the respective detail drawings or specifications pertaining to specific items required to complete the work. Perform work according to best standard practice.
3. Install no multiple assemblies on plastic lines. Provide each assembly with its own outlet.
4. All threaded pipe and fittings shall be assembled using an approved teflon tape, or equivalent, applied to the male threads only. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved teflon tape will be required.
5. No main line elbows, branch tees or isolation valves are to be located closer than five (5) feet to each other without prior approval of the Owner.

E. Line Clearance: All lines shall have a minimum clearance of four inches (4") from each other, and six inches (6") from lines of other trades. Parallel lines shall not be installed directly over one another.

F. Plastic to Steel Connections:
1. At all plastic (PVC) pipe connections, the Contractor shall work the steel connections first. Connections shall always be plastic into steel, never steel into plastic. An approved teflon tape shall be used on all threaded (PVC) to steel, never steel into plastic. An approved teflon tape shall be used on all thread (PVC) to steel pipe joints applied to the male threads only, and light wrench pressure is to be applied. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved 3/4" wide teflon tape will be required.
2. A non-hardening sealant and lubricant similar to Permatex #51 or LASCO blue pipe sealant may be used in lieu of teflon tape. Apply sealant to clean male threads brushing into grooves and to the first three threads of the female threads.

G. Plastic Pipe:
1. The Contractor shall exercise care in handling, loading, unloading, and storing plastic pipe and fittings. All plastic pipe and fittings shall be stored under a weatherproof roofed structure before using and shall be transported in a vehicle with a bed long enough to allow the length of pipe to lie flat so as not to be subject to undue bending or concentrated external load at any point.
a. All lumber, rubbish, rubble, concrete and rocks shall be removed from the trenches by the Contractor. Pipe shall have a firm uniform bearing for the entire length of each pipe line to prevent uneven settlement. Wedging or blocking under riser tees shall be done only if specified on the plans. Pad trenches with soil as necessary to provide uniform bearing surfaces.
b. Where extensive lengths of pipe are installed, snake pipe in trench from side to side to allow for expansion and contraction. One additional foot per one hundred (100) feet of pipe is the minimum allowance for snaking. Never lay pipe when there is water in the trench or when the temperature is 32 degrees F or below.

c. All changes in direction of pipe shall be made with fittings, not by bending. No main line fittings for changes in direction shall be greater than 45 degrees. Provide a minimum five (5) feet between changes in direction fittings.
d. Safely handle primers and cements per ASTM F-402. Make solvent weld joints per ASTM D-2855 with a non-synthetic bristle brush in the following sequence:
    1) Make sure pipe is cut square and all rough edges and burrs are removed. All connecting surfaces are properly cleaned and dry prior to application of pipe primer.
    2) Apply an even coat of colored primer to pipe and fitting prior to application of solvent.
    3) Apply an even coat of solvent to the outside of the pipe, making sure that the coated area is equal to the depth of the fitting socket.
    4) Apply an even light coat of solvent to the inside of the fitting.
    5) Apply a second coat of solvent to the pipe.
    6) Insert the pipe quickly into the fitting and turn pipe approximately one-eighth to one-quarter turn to distribute the solvent and remove air bubbles. Hold the joint for approximately fifteen seconds so the fittings do not push off the pipe.
    7) Using a clean rag, make sure to wipe off all excess solvent to prevent weakening at joint.
    8) Exercise care in going to the next joint so that pipe is not twisted, thereby disturbing the last completed joint.
    9) Allow at least fifteen minutes setup time for each welded joint before moving.
    10) Repairing plastic pipe when damaged shall be done by replacing the damaged portion of pipe.

H. Concrete Thrust Blocks: Concrete anchors or thrust blocks shall be provided on pressure main pipelines 2 inches or greater in diameter at abrupt changes in pipeline grade, changes in horizontal alignment (bends, tees and crosses), reduction in pipe size (reducers, reducing tees or crosses), end-line caps or plugs, and/or in-line isolation valve to absorb any axial thrust of the pipeline. The pipe manufacturer's recommendation for thrust control shall be followed. Thrust blocks must be formed against solid unexcavated earth (undisturbed). Do not enclose entire joint in concrete. Provide a minimum of three cubic feet of concrete for each thrust block.

I. Concrete thrust blocks may be eliminated if the main line piping system uses self-restrainted fittings and bell joint restraints per manufacture’s specifications throughout.

3.03 PIPE DEPTH AND BACKFILL

A. Backfill shall not be placed until the installed system has been inspected, pressure tested and approved by the Owner.

B. Backfill for first 6 inches underneath, and 4 inches around and above main line pipe and control wires shall be granular bedding material, unless the Owner approves in writing that native soil may be used for initial backfill in lieu of granular bedding material. Backfill material for the upper portion of the trench shall be approved soil. Unsuitable martial, such as pipe remnants and wire including clods and rocks over two inches (2") in size, shall be removed from the premises and disposed of legally at no cost to the Owner.

C. Backfilling for all pipe shall be carried out in two basic stages.
   1. Stage One Backfilling: This shall be accomplished as soon as possible after the pipe is laid. A bedding of uniform depth with no voids must be provided along the entire length of the pipe. The bedding material should be placed in the trench and tamped into the areas under the pipe, using a suitable tool. Joints should be left exposed until hydrostatic tests are completed. Cover only those portions of the pipe necessary to prevent movement or damage.
   2. Stage Two Backfilling: This shall be completed after all hydrostatic tests are completed and the piping system has been thoroughly checked for leaks or other defects. Continue to add backfill material in four inch (4") layers and hand tamp to achieve density similar to adjacent soil. After twelve inches (12") in main line trenches and eight inches (8") in lateral line trenches of hand tamped soil is in place over the pipe and fittings, backfilling can be continued, using light machinery to place dirt in the trenches in six inch (6") layers and to compact the dirt to conform to adjacent soil. Extreme care should be taken to avoid damage to the pipe from machinery that is too heavy. All trenches shall then be water jetted to assure uniform settling and compaction. Backfilling operations will not be considered complete until the top surface has been graded to conform to the adjacent soil. All rocks uncovered and not used as backfill must be collected and removed from the site.

D. All backfilling shall be done carefully and shall be properly tamped. All soil shall be tamped and puddled to eliminate any voids.

E. Surplus earth remaining after backfilling shall be disposed of as directed by the Owner.

F. PVC piping and fittings shall not be backfilled during periods of extreme heat or when a sudden lowering of temperature of the pipe may cause separation of joints or fittings.

G. Contractor shall fill with properly amended topsoil any irrigation trench that subsides during the warranty period. Contractor shall assume all cost associated with the trench repair, including but not limited to plant replacement of a size of plant disturbed at the time of the repair.

3.04 CONTROL AND TRACER WIRE, AND COMMUNICATION CABLE

A. Do not tape wires together when encased in sleeve or conduit. Minimum cover shall be 24 inches. Crimp wires together at valve manifold with Scotchlok connector. Conventional valve wire splices shall use a 3M DBY splice kit. Tag all control wire at splices with approved control wire markers.

B. Wire size shall be determined by the number of valves operating on a given wire and the distance from the controller to the farthest valve, as specified by the charts furnished by the remote control valve manufacturer. Splices are only allowed when rerouting or repairing existing wire. All splice connections must be provided in a valve box.

C. Communication/sensor cable shall be installed in electrical conduit with long radius sweeps at direction changes and at valve/splice/pull boxes. Maintain a minimum six inch clearance to adjacent pipe. Minimum cover shall be 24 inches.

D. Install tracer wire along the top of pipe at the following locations:
   1. All pipe sleeves.
   2. Main line pipe without adjacent control wire.

3.05 VALVES

A. The Contractor shall make all necessary connections for operation, and shall be connected and aligned to provide the most efficient flow of water to the irrigation heads. Where pressure regulating electric control valves are specified, the Contractor shall adjust the valve so a uniform distribution of water is applied by the heads, and that the most remote heads operate at the pressure recommended by the head manufacturer.

B. Each valve is to be enclosed in a separate valve box. The valve box shall be secured on firm soil clear of valves and wiring connections. Valve boxes and lids shall be set to finished grade or as indicated on the Drawings. Use valve box extensions of the same material as the box to the proper depth below the pipeline. Valve boxes shall be supported by common bricks at each corner and at the long side of the box. Use a minimum of six bricks to support rectangular boxes and four bricks to support round boxes. Backfill carefully and properly compact in order to prevent settlement and subsequent damage.

C. Install a concrete collar around valve boxes when located in asphaltic concrete pavement or in turfgrass areas.

~~D. Remote control valve boxes within the field of play at sports venues shall be buried with a minimum of 8 inches of cover over the box lid in turfgrass, and a minimum 3 inches in skinned infield or warning track surfacing.~~

~~E.~~D. When existing valve and/or splice boxes are within the area of work, replace in kind any damaged boxes and/or lids, unless noted otherwise. Adjust the elevation of all existing boxes within the area of work to final grade per the drawings.

~~F.~~E. Locate valve boxes in ground cover/shrub planting areas instead of turfgrass areas whenever possible. Locate valve boxes 18” from and perpendicular to adjacent paving. When grouped together, provide equal spacing of at least 36" between boxes.

~~G.~~F. Permanently attach the plastic valve identification tag to the remote control valve body and locate so it’s clearly visible in an open valve box.

~~H.~~G. Permanently ~~secure~~ provide ~~the control~~ valve identification ~~label~~ markings to the top of ~~concrete~~ valve box lids ~~with non-corrosive connectors~~.

3.06 AUTOMATIC CONTROLS

~~A. Install the controller and/or associated equipment, enclosure, sensors, and accessories per the manufacturer’s details and installation requirements, and the construction documents.~~

~~B. Where the controller is not connected to a building’s electrical grounding system, install a grounding circuit for controller and associated equipment with either a ground rod or ground plate per ASIC Guideline 100-2002.~~

~~C. Where the new controllers are a site satellite controller in a central control system, the site satellite controller equipment and installation shall be reviewed for system compliance by an authorized central system distributor/installer.~~

~~D.~~A. Connect operational control wires or accessory components to the existing controller, and program valve schedules appropriately for the new planting.

~~E.~~B. The Owner shall review the fully functional operation of the irrigation control system prior to acceptance of the system, and as a requirement for the start of maintenance.

~~F.~~C. Install automatic controller chart in laminated or watertight plastic envelope inside controller cover showing which valves are connected to which stations on controller in the work area.

3.07 SPRINKLER HEAD INSTALLATION

A. ~~Head spacing on drawings is diagrammatic. Head spacing and patterns shall be adjusted to provide complete and adequate coverage with a minimum spray on non-planted areas.~~ Flush all lines prior to installation of heads.

~~B. Overhead distribution sprinkler heads shall be installed as detailed, set adjacent to the edge of hardscape elements (2 - 4 inches for spray heads, 6 - 8 inches for rotary heads) and perpendicular to the finish grade. Sprinkler spray heads directed toward a building shall be a minimum 7 feet from building walls, and a minimum 2 feet when directed away from the building. Sprinkler heads in turfgrass areas shall have a minimum 10 foot radius except for corners.~~

~~C. The top of the nozzle in pop-up bodies shall be flush to the finish grade in areas to receive turfgrass seed/stolons, and in ballfield skinned infields. The top of the nozzle shall be one-half inch (1/2") above the finish subgrade in areas to receive standard cut turfgrass sod.~~

~~D. High speed or other sprinkler heads in dust control zones at ballfield skinned infields shall be installed in turfgrass areas where directly adjacent to the skinned infield.~~

~~E.~~B. Where individual ~~shrub~~ tree bubblers are installed, each ~~plant shall have a~~ bubbler ~~within 10 - 14 inches of the shrub center.~~shall be located within the planting pit and adjacent to the rootball.

~~F.~~C. Upon completion of the installation, the Contractor shall adjust or change sprinkler head nozzles to uniformly distribute water without overspray and shall place entire irrigation system in first-class operating condition without any additional cost to the Owner.

~~G.~~D. Sprinkler heads shall be adjusted in order by fully opening the sprinkler furthest from the control valve and working back toward the control valve. Adjust sprinkler heads which spray toward buildings or adjacent hardscape so that water spray does not contact the side of buildings or significantly over-spray onto hardscape .

3.08 DRIP IRRIGATION SYSTEM

A. Install control valves, wye strainer, pressure regulator and rigid PVC lateral distribution lines or manifolds prior to planting soil conditioning operations.

B. Install in-line emitter tubing as follows:
   1. After planting soil has been amended, tilled and rough graded, remove and stockpile the planting soil to the required depth of the in-line tubing, and install and stake drip tubing taking into account adjustments needed in the tubing location based on the planting layout. Stake in-line tubing at every-other emitter. Install flush and air relief valves, and operation indicator. Install the operation indicator on the supply manifold with a swing joint in a location easily visible by maintenance personnel.
   2. After system flushing, verification of proper operation and inspection, reinstall the stockpiled planting soil and finish grade to final elevation.

C. Operate the system to moisten the planting soils to a minium 8 inch depth prior to planting operations.

D. Program the controller to operate the drip system using the controller's "cycle and soak" feature in order to apply the required daily watering amount in three equal cycles with a one hour delay between cycles.

3.09 CONCRETE

A. Concrete shall be installed in accordance with the relevant portions of the Site Concrete specification section.

3.10 COMPLETION AND MAINTENANCE

A. After the system has been completed but prior to the start of maintenance, the Contractor shall operate the automated system with the Owner, shall instruct the Owner in the operations and maintenance of the system and controls, and shall program the controller for each station.

B. If site satellite controller(s) for a central control system is installed, an authorized central control distributor/installer shall program the central base station to communicate with the site satellite controller(s), and shall verify that proper communication protocols are operational.

C. The irrigation system shall be maintained and adjusted as required to provide proper coverage throughout the maintenance period or until Final Acceptance of the project, whichever is greater. Irrigation system maintenance shall commence upon an acceptable review following the completion of irrigation installation, planting operations and general clean-up.

D. The maintenance period shall not terminate until the close-out documents and as-builts record drawings have been submitted and accepted.

3.11 REPAIR AND CLEAN-UP

A. All areas shall be maintained in a neat and orderly condition at all times. All reasonable precautions shall be taken to avoid damage to new planting and improvements. Disturbed and/or damaged areas shall be restored to their original condition to the satisfaction of the Owner.

B. Where trenching or other work disturbs existing and/or newly planted turfgrass and/or planting, the Contractor shall reinstall the existing sod if viable, or install a full width of new turfgrass sod or new planting to match the existing turfgrass/planting species, variety and size, after first conditioning the top 6 inches of soil per the Landscape Planting specification. Adjust finish grades to account for the new turfgrass sod's soil mat so that the new sod is flush to the adjacent turfgrass.

C. After the irrigation operations are completed, the Contractor shall remove all trash, excess materials, empty containers or any other debris accumulated by the work from the site. All damage caused by the work shall be repaired or material replaced at the Contractor's expense. The site shall be left in a neat and orderly condition to the satisfaction of the Owner.

END OF SECTION

SECTION 329000 - LANDSCAPE PLANTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all material, labor and equipment necessary to install all landscape work as indicated in the plans and specifications.

B. The landscape work includes but is not necessarily limited to the following:
1. Soil preparation including cross ripping of all planting soil.
2. Weed control including an application of a pre-emergent herbicide.
3. Providing import planting topsoil at raised grade planters and/or at planting areas needing fill.
4. Fine grading, conditioning and amending planting topsoil.
5. Planting new trees, plants and ground covers.
6. Tree drainage sump boring and testing.
7. Root Barriers.
8. Installation of mulch.
9. Ninety (90) day maintenance.

C. Related Work Specified Elsewhere
1. Contract Drawings, Addenda, general provisions of the Contract, including General and Supplemental Conditions, and Division 1 Sections apply to work of this section.
2. Section 31 20 00 - Earthwork
3. Section 31 22 22 - Soil Materials
4. Section 32 01 90 – Existing Landscape Protection
5. Section 32 84 00 - Irrigation System

1.02 1.03 DEFINITIONS

A. Unless noted otherwise, the term "approved" shall mean by the Owner in writing.

B. Agencies and Organizations:
1. ASTM- American Society for Testing and Materials
2. ANSI – American National Standards Institute
3. ISA – International Society of Arborists
4. SSPWC – Standard Specifications for Public Works Construction, by the American Public Works Assoc./Associated General Contractors of California.
5. TPI – Turfgrass Producers International

C. Owner: The Owner’s authorized representative or authorized consultant.

1.03 QUALITY ASSURANCE

A. The work of this Section shall be performed by a single firm experienced in landscape planting and holding a current California Contractor’s A or C27 License.

B. Tree and plant quality and sizes shall conform to the current edition of “American Standard for Nursery Stock” for Number One nursery stock as adopted by the American Nursery & Landscape Association (ANSI Z60.1). Plants shall be of uniform, standard size for their

listed container size, neither overgrown and root bound or encircling, nor so recently transplanted that the root system is not thoroughly well established throughout the container. Roots should reach the sides of the container and maintain a firm root ball. Pruning shall not be done prior to delivery except by prior approval.

C. Trees shall also comply with quality characteristics described in "Guideline Specifications for Nursery Tree Quality" current edition, published by the Urban Tree Foundation. Trees not in compliance with any of the following characteristics may be subject to removal and replacement, whether planted or still in their containers.
   1. Acceptable caliper and height ranges for the Type, Form and Size of tree.
   2. An intact central leader, or after heading of an old leader, the new leader diameter is greater than one-half the diameter of the old leader. Co-dominant leaders are not acceptable.
   3. Scaffold branch diameters are less than two-thirds the diameter of the trunk, and without included bark at the attachment.
   4. Scaffold branches shall be balanced, well spaced vertically, and with a radially blank section no greater than one-third of the canopy circumference.
   5. Temporary branches on the lower trunk shall be less than three-eighths inch diameter, and the clear trunk height shall be no more than forty (40) percent of the overall tree height.
   6. The root collar and rootball shall be free of defects, including circling, kinked and girdling roots. Roots at the edge and bottom of the container shall be less than one-quarter inch diameter, and uniformly distributed throughout the container.
   7. The tree canopy width shall be a minimum of twenty-five percent of the standard form tree height, except for naturally columnar forms.

D. Botanical names shall take precedence over common names. Provide plants that are true to name. Tag one representative plant of each species and size with the botanical name and size.

E. Inspection:
   1. All landscape work and materials shall comply with applicable Federal, State, County and City regulations.
   2. All plant material shall be reviewed onsite or by providing photo submittals by the Owner's Representative and/or Landscape Architect prior to positioning and planting. The lack of a review shall not limit the right of rejection during any stage of the work until Final Acceptance for any reason including condition of the foliage or root ball, size, variety, form, appearance, latent defects or injuries or location errors. Rejected or wrongly located plants shall be removed/relocated from/on the site and replaced/replanted immediately by the Contractor as directed at no additional cost to the Owner.

F. Qualifications of Workers
   1. Employ skilled workers who are thoroughly trained experienced in landscape planting and who are completely familiar with specified requirements and methods needed for proper performance of the work in this section.
   2. Provide adequate supervision by a qualified foreman fluent in English that will be continuously onsite during the performance of this work.
   3. Weed control pesticides shall only be applied by an individual holding a valid Qualified Applicator Certificate (Category A) issued by the Department of

Pesticides Regulation. Submit a copy of the Certificate.

G. Any pruning of existing trees specified as part of this Work shall be performed under the direct supervision of an ISA Certified Arborist and in compliance with ANSI A300-Part 1 Standard Practices (Pruning).

1.04 SUBMITTALS

A. In accordance with the Submittal section, submit:
   1. A complete materials list of all items proposed to be furnished including estimated quantities.
   2. Laboratory analyses of soil conditioning materials, e.g. organic compost, shall have been performed within three months of the submittal date.
   3. Quality Certificates and/or Certificates of Inspection required by government agencies (providing duplicate copies for the Owner's Representative).
   4. Qualified Applicator Certificate, and DPR Registration Certificates and Material Safety Data Sheets for all pesticides/herbicides proposed for use.
   5. Submit photos with a scale marker of all boxed trees, and a representative photo of each species/variety of ground plane plants proposed for use from the nursery source. Photos shall clearly show the individual tree or plant form without background greenery.

B. Soil amendments: Submit one (1) pint sample of both organic compost and mulch.

C. Other Samples: When requested by the Landscape Architect and/or Owner's Representative.

D. Soil Fertility Analysis and Recommendations:
   1. The Contractor shall provide and pay for a fertility analysis of the existing topsoil and any proposed import planting topsoil. After mass grading operations are completed, native soil samples shall be collected for the fertility analysis by collecting a minimum of 5 representative samples of the soil per acre throughout the area of work. Separate samples shall be produced for cut and fill areas, and for any other area composed of soils not similar to the existing soils. Each sample shall be a minimum of one pint each, and shall be thoroughly mixed together to prepare a homogenous sample. A one quart representative sample for cut, fill and any other special conditions shall be submitted to the soil testing laboratory as a representative sample for fertility analysis. The fertility analysis shall at a minimum provide the following data:
      a. soil texture class and percent sands, silts and clays per ASTM D422
      b. estimated soil infiltration and percolation rates
      c. pH
      d. organic matter (%)
      e. total soluble salts (ECe)
      f. Cation Exchange Capacity (CEC) and Percent Cation Saturation for K, Mg, Ca and Na
      g. major and minor nutrients (ppm).
   2. Recommendations for improvement of the soil conditions for optimum plant growth shall be made by the testing laboratory, and at a minimum shall include the following:

a. A fertilizer and amendment application program (including macro and micro nutrients) for both pre-planting and maintenance fertility applications for broad area tillage and for planting pit backfill (pre-plant only).
b. Treatments to neutralize soil pH and to correct any adverse conditions as warranted.
c. Recommendations shall address soil conditioning for both planting area tillage and tree/plant planting pit backfill.

3. The soil analysis and recommendations shall be performed by one of the following laboratories capable of providing the above analyses by a licensed soil scientist:
a. D&D Agricultural Laboratory. Contact Darrin Peters at 559-348-1818.
b. Wilber-Ellis Company. Contact Michael Cline at 209-442-1220.
4. The Contractor shall submit the results of the soil testing investigations and shall receive written direction from the Landscape Architect before proceeding with any soil conditioning activities such as fertilizing and/or tillage of amendments.

E. Within seven days from the start of the maintenance period, submit a calendar of maintenance activities, including scheduled dates for mowing, fertilizing, weed control and all other activities. Provide the quantities of maintenance fertilizer and any other materials scheduled to be used in each application during the maintenance period.

F. Submit invoices and/or delivery tags from material suppliers for all amendments, fertilizer, seed, plants, mulch and any other materials provided for the landscape planting installation and applied during the maintenance period. Submit tags from seed packaging indicating seed varieties, percent purity and percent germination minimums. The invoices and/or delivery tags shall be provided directly to the Owner’s Representative/Inspector of Record within 24 hours of delivery to the site, as well as to the normal submittal recipients per the Contract Documents.

G. Close-out Documents: Submit prior to the end of the maintenance period. Acceptance of the Close-out documents in a condition for scheduling a Final Acceptance review. Provide two bound copies of the following:
1. Cover sheet stating Contractor's address and telephone number, duration of guarantee period, and a list of plant nurseries, materials and equipment vendors with names and addresses of the vendor/manufacturer representatives and warranty periods.
2. A "CERTIFICATE OF CONSTRUCTION COMPLIANCE" which indicates that all work done, materials and equipment used and installed are in compliance with the approved plans, specifications and all authorized revisions.
3. Maintenance Manuals and Instructions: Submit a monthly schedule of procedures to be established by Owner for maintenance of landscapes (trees, mixed planting and turfgrass) for one full year and shall include recommendations for fertilizing, pest and disease control, weeding, mowing, aeration and top dressing.
4. Soil Amendment and/or Seed/Stolon confirmation form noting the installed quantities of materials, tags or invoices from Subsection F. above, and the person who confirmed the delivery and installation of the materials.
5. Operations and Maintenance Manuals and Warranty certificates for any maintenance equipment turned over to the Owner.
6. As-built Record Drawings with all modifications to the Drawings noted in red ink, and the Landscape Planting Observation Log completed.

1.05 AVAILABILITY

A. The Contractor shall confirm availability of plants, supplies, and materials prior to submitting his landscape bid. Plant variety substitutions are not desired.

B. If a plant is found not to be suitable or available, the Contractor shall notify the Landscape Architect before bidding. The Landscape Architect shall then select a reasonable alternate and to inform all those bidding of the availability of the original plant. If a substitute is selected it must be of the same size, value and quality as the original plant. Failure to inform the Landscape Architect of unavailable plants prior to bidding will require that all plants specified shall be provided by the Contractor at time of installation.

C. Plant container size listed on construction documents are minimum acceptable size. If plant material specified is not substituted prior to award of the contract the minimum container size specified shall be provided by the Contractor. If the Contractor can not provide the minimum specified size plant material at the time of installation, the Contractor shall be required to install a larger size container of the plant specified at no additional cost to the Owner.

1.06 EXISTING CONDITIONS

A. The Contractor is to visit the job site to verify existing conditions including soils, vegetative growth, subsurface conditions, existing grade and drainage, irrigation system etc. making allowances in his bid for any required work to provide the landscape installation as specified in the construction documents.

B. The Contractor shall notify the Owner to locate underground lines prior to hole boring or trenching. Do not permit heavy equipment such as trucks, rollers, or tractors to damage utilities. Hand excavate as required to minimize possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned. Prevent damage to temporary risers of underground irrigation system and similar obstructing work located in the landscape areas.

C. If there is a conflict with existing utilities, improvements and/or planting and the proposed planting, Contractor shall promptly notify the Owner's Representative for instructions as to further action. Failure to do so will make Contractor liable for any and all damage or corrective actions arising from his operations.

D. Prior to the start of this work, the Contractor and the Owner’s Representative shall verify the operational condition of that portion of the existing irrigation system pertaining to the proposed planting area. The Contractor shall notify the Owner’s Representative of any repairs and/or corrections necessary for proper functioning and coverage. The repairs and/or corrections shall be completed before any plant material is planted. Failure to perform system verification and provide notification prior to the start of this work will make the Contractor liable for any and all repairs and/or corrections necessary for proper functioning and coverage, as well as any required plant replacement, without any additional cost to the Owner.

E. No plants shall be planted in situations that show poor drainage infiltration or low areas that result in standing water. Such situations shall be corrected by the Contractor as directed by the Landscape Architect or Civil Engineer. Failure by the Contractor to notify

the Owner of poor drainage conditions prior to proceeding with the conditioning or planting operations shall place the responsibility for any plant removals, additional soil conditioning and replanting on the Contractor without any additional cost to the Owner. Any corrections of finish grading not in compliance with the Contract Documents including plant removal, soil conditioning and replanting shall be performed by the Contractor at no additional cost to the Owner.

1.07 PROTECTION

A. The Contractor shall guarantee repair of damage to any part of the premises resulting from but not limited to leaks, defects in materials or workmanship, operation of equipment, storage of materials and/or equipment, installation of underground or overhead utilities. The Contractor shall be liable for any and all accidents resulting from his work, including open holes and trenches during construction.

B. Protect new and existing landscape areas in the area of work from theft, loss, damage and deterioration during storage, installation and maintenance. Protect from unauthorized persons (trespassers) as well as from operations by other contractors and tradesmen, and landscape operations. Protect all planted turf and shrub areas from persons as well as operations of other contractors and the Owner. Cost of protection shall be born by the Contractor with means of protection such as temporary fencing as approved by Owner. Cost for protection shall be included in the Contractor's bid for the work.

C. Contractor shall repair or replace damaged work and/or damage to existing improvements/landscape as identified by the Owner's Representative to a condition acceptable to the Owner's Representative. No additional payment will be made to the Contractor for repair or replacement of damaged work and/or damage to existing improvements/landscape.

1.08 OBSERVATIONS

A. The Owner's Representative, Project Inspector or Landscape Architect shall perform periodic observations and shall record the observation on the Landscape Planting Observation Log form on the As Built Record Drawings. Such observations shall include but are not necessarily be limited to:
   1. Weed control operations prior to other portions of work.
   2. Ripping and soil conditioning of the planting area.
   3. Layout of the plant material and trees at the site prior to planting in order to avoid conflicts and to meet the design intent.
   4. Condition and quality of plant material prior to planting.
   5. Auguring, digging and preparation of plant pits and drainage sumps for trees and shrubs.
   6. Planting and staking of trees.
   7. Planting of shrubs, ground cover and turfgrass.

B. Any corrective action called for shall be immediately performed by the Contractor.

C. Failure by the Contractor to obtain the above observations shall place the responsibility on the Contractor for any relocation and/or replacement of planted trees or shrubs.

1.09 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Plant label shall identify each species and variety. A label shall be attached to each individual plant or block of identical plants grouped together.

B. Adequately protect plants from sun and wind prior to planting. Do not allow stored plant material to dry out at any time.

C. Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at the site. Store materials and equipment in a location as directed by the Owner's Representative.

1.10 PESTICIDE NOTIFICATION

A. A written notification of any and all pesticide/herbicide products scheduled for use by the Contractor or their representative on the Owner's property must be submitted to the Owner's Representative at least seven days prior to the scheduled application. Notification shall include the product name, manufacturer's name, the pesticide active ingredient, the U.S. EPA and CalDPR registration numbers, the scheduled date and application areas, and the reason (target species) for the application.

1.11 REPAIR OF DAMAGED EXISTING PLANTING AREAS

A. The Contractor shall be responsible to repair all damage and/or distress to existing planting areas including turfgrass, shrubs, ground covers, perennials, etc., whether specifically shown on the Contract Documents or not, as a result of construction operations, material and/or equipment storage, site access, site offices, utility and/or irrigation line installations or other actions.

B. Replacement shrubs shall be 15 gallon size, replacement ground cover and perennial plants shall be 5 gallon size, and turfgrass shall be full width sod. Damaged areas shall be amended and finish graded per the Contract Documents prior to planting. Damaged areas outside of the limit of work shall be returned to the pre-construction condition with new replacement plants and/or turfgrass sod. Non-turfgrass planting areas shall also receive wood mulch as specified herein. The limits of repair shall be determined by the Owner.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Topsoil used in planting areas shall be a clean, friable soil with no noxious weeds, clods or stones larger than 0.5 inch in diameter, subsoil, hardpan, wood, debris, fine organic material greater than 5%, undesirable insects, plant disease or any other natural or extraneous objects detrimental to normal plant growth to a minimum depth of 18 inches from finish grade.

B. The Contractor shall provide a particle size analysis, fertility testing and amendment recommendations of proposed native and/or import topsoil, and the Landscape Architect reserves the right to reject topsoil not conforming to the minimum specifications. Stockpiled onsite topsoil may be used if analysis and testing determines compliance with these requirements prior to placement. Failure to meet minimum specifications shall result in the removal of any unauthorized placed topsoil at the Contractors expense.

C. Particle size distribution for topsoil shall meet the following per ASTM D422:
1. 100% passing a 12.2 mm (1/2") screen.
2. Minimum 95% passing a 9.5 mm (3/8") screen.
3. Minimum 75% passing a 2.36 mm (No. 8) screen.
4. Maximum 45% passing a No. 200 screen.
5. Silt content shall be a maximum 35%.
6. Clay content shall be a maximum 25%.
7. Silt to Clay ratio shall be less than 2 and greater than 0.5.

D. Other characteristics shall conform to the following:
1. Permeability rate shall be not less than one (1.0) inch per hour or not more than 20 inches per hour.
2. The sodium absorption ratio (SAR) shall not exceed 3.0 and the electrical conductivity (ECe) shall not exceed 2.5 milliohms per centimeter at 25 degrees centigrade.
3. Soluble boron shall be no greater than 1.0 part per million (mg/l).
4. Soil pH range shall be 6.5 – 7.9.
5. Maximum concentration of soluble chloride shall be 150 parts per million.
6. Maximum concentration of heavy metals shall not exceed the following when the pH is between 6 and 7:
   a. Arsenic: 0.5 ppm
   b. Cadmium: 0.5 ppm
   c. Chromium: 5 ppm
   d. Cobalt: 1 ppm
   e. Lead: 15 ppm
   f. Mercury: 0.5 ppm
   g. Nickel: 2.5 ppm
   h. Selenium: 1.5 ppm
   i. Silver: 0.25 ppm
   j. Vanadium: 1.5 ppm
7. Petroleum hydrocarbons shall not exceed 100 mg/kg dry soil.
8. Aromatic volatile organic hydrocarbons shall not exceed 2 mg/kg dry soil.

2.02 SOIL AMENDMENTS

A. Organic Compost: "Harvest Premium" as supplied by Harvest Power (559) 435-1114; "WonderGrow Compost" by Grover, Inc. (866) 764-5765, or "Allgro Compost" by Synagro (559) 341-5158, or approved equal and conforming to the following minimums per the US Composting Council 'Compost Technical Data Sheet' report dated within three months of the submittal date:
1. Certified as "Mature" or better
2. Pass EPA Class A standards for pathogens and heavy metals.
3. Particle size: 1/8" maximum
4. pH: 6.0-7.5.
5. Macro-nutrients: Minimum of 1.0% Nitrogen, 0.5% Phosphorus, 0.5% Potassium.
6. AgIndex ratio (Nutrients/Salts) 10 or more.
7. Ammonia N/Nitrate N ratio: rated Mature or Very Mature
8. Organic matter content greater than 25% dry weight.
9. Carbon/Nitrogen ratio: less than or equal to 15.

10. Salinity (ECe): less than 5.0 dS/m.
11. Odor shall be soil-like (musty, earthy) without any sour, ammonia-like or putrid smell.

B. Gypsum shall be mined agricultural grade gypsum composed of no less than 95% $CaS0_4$-$2H_20$ hydrated calcium sulfate in a pelletized form. Elemental Sulfur shall be a minimum 95% pure agricultural grade.

C. Dry Humate organic soil conditioner comprised of a minimum 40% humic acid from Leonardite.

D. Endo 120 Mycorrhizae containing a minimum 60,000 living propagules per pound.

E. Amendment material types and application rates may be subject to change based on the findings and recommendations of the horticultural soil testing lab, and as such may result in an increase or decrease in the Contract Amount.

2.03 FERTILIZER

A. Trees and Shrubs: Fertilizer for all trees and shrubs to be BEST PAKS (20-10-5) controlled release fertilizer in a biodegradable 10 gram packet. The BEST PAKS shall be applied at the following rates:
1. 1 Gallon Can: 1 Best-Pak
2. 2 Gallon Can: 2 Best-Paks
3. 5 Gallon Can: 5 Best-Paks
4. 15 Gallon Can: 10 Best-Paks
5. 24” Box: 16 Best-Paks
6. 36” Box: 24 Best-Paks

B. The pre-plant fertilizer shall be a commercial homogeneous, granular pellet:
1. Pre-plant fertilizer for turfgrass shall be:
   a. BEST 6-24-24-5S XB+ with Avail
2. Pre-plant fertilizer for mixed plantings shall be:
   a. BEST Landscape Color 14-14-14 (14-6-11.6-3S and micronutrients) with 9.9% slow release N, or equal.

C. The maintenance fertilizer shall be a commercial homogeneous, granular pellet:
1. Maintenance fertilizer for turfgrass shall be one or more of the following:
   a. Urea 46-0-0
   b. BEST Ammonia Sulfate 21-0-0-24S, standard grade, or equal
   c. BEST Nitra King 21-2-4-14S-2Fe, or equal.
   d. BEST Nitex 20-2-3-12S-5Fe, or equal.

D. Fertilizer material types and analysis may be subject to change based on the findings and recommendations from the horticultural soil testing lab, and as such may result in an increase or decrease in the Contract Amount.

2.04 MULCH

A. Mulch for on-grade or raised native soil planters shall be a walk-on type of chipped and aged greenwaste woody material without leaves, green wood, sticks, dirt, stones, dust and other non-organic debris as accepted by the Landscape Architect. Particle size 1/2” to 3" in

general size.

2.05 STAKING & GUYING MATERIALS

A. Stakes: 2" Diameter lodgepole pine, pressure treated and pointed one end.

B. Ties: V.I.T. Cinch Tie, 32 inches long, V.I.T. Products, Inc. (619) 673-1760, or equivalent.

2.06 PLANTS

A. Plants shall be typical of their species and variety, shall have normal growth habits, well developed branches and be densely foliated, and shall have fibrous root systems. No substitutions will be allowed unless approved in writing by the Landscape Architect.

B. Plants shall be free from defects and injuries including disease, insects, insect eggs and larvae and girdled or matted roots.

C. Quality and size of plants shall be in accordance with ANSI Z60.1-2004, "American Standard for Nursery Stock", and as described in Quality Assurance.

D. Plants shall not be pruned before planting.

E. Plant material must be selected from nurseries that have been inspected by State or Federal Agencies.

F. Plants shall be nursery grown and shall have been transplanted or root pruned at least once in the past three (3) years. Plants shall have been grown under climatic conditions similar to those in the locality of the project.

G. Each bundle of plants shall be properly identified by weatherproof labels securely attached thereto before delivery to the project site. Label shall identify plant by name.

H. Nomenclature shall be in accordance with Sunset Western Garden Book, current edition.

I. No plants shall be removed from their container until a review has been made in the field or at the nursery, or except when specifically authorized in writing by the Owner.

J. Collected plant material may be used only when approved. Approval shall not limit the right of rejection during work progress for conditions of the root ball, latent defects or injuries.

K. Where shown a "MULTI" provide trees with a minimum of three trunks.

L. Plant sizes listed on the planting plan are minimum acceptable sizes. The quantities listed are the Landscape Architect's estimate only. The Contractor is responsible for the quantities of plant symbols shown on the plan, and/or the quantities in hatched planting areas at the specified triangular spacing.

2.07 TURFGRASS SOD

A. Sod shall be produced from certified or approved seed/stolons, fresh and labeled in

accordance with U. S. Department of Agriculture Rules and Regulations. Sod quality shall be Premium or Standard Grade per TPI specifications.

B. Sod shall be neatly mowed and be mature enough that when grasped at one end it can be picked up and handled without damage, delivered to the project site, adequately protected and installation commenced within 24 hours of harvesting.

C. Turfgrass shall be a species and variety as specified in the Contract Drawings. If a warm-season grass is specified and the installation is to be performed between the months of October and April, a species with an established perennial ryegrass overseeding shall be installed. Submit the overseeded product information for approval prior to the installation.

2.08 ROOT BARRIER

A. A ribbed polyethylene panel of minimum 0.080" thickness equal to Deep Root Partners #UB 24-2 PANEL, (800) 458-7668..

2.09 TREE TRUNK PROTECTOR

A. ArborGard+ polyethylene tree guard by Dimex (800) 334-3776, or equal.

2.10 HERBICIDES

A. Herbicide products for removal of unwanted grass and broad-leafed weeds shall be registered and approved for use by the U.S. EPA and CalDPR, and shall comply with the Owner's Standards, with the "Healthy Schools Act" with current amendments, and with the current list of prohibited herbicides at Schools and Child Care facilities per California Assembly Bill 405.

B. Provide pre-emergent and post-emergent, selective herbicide formulations for use on turfgrass areas and/or ornamental shrub/ground cover areas that are not injurious to the proposed plantings and turfgrasses.

C. Provide a non-selective contact herbicide formulation only for use to remove existing established weeds prior to new plantings. The herbicide shall be certified for organic use, broad-spectrum with systemic function, 'Weed Slayer' by Agro Research International, or equal.

2.11 OTHER MATERIALS

A. Materials not specifically indicated, but necessary for proper execution of the work, shall be of first quality as selected by the Contractor subject to approval of the Landscape Architect.

PART 3 - EXECUTION

3.01 EXAMINATION & PREPARATION

A. General: Verify that existing site conditions are as specified and indicated before beginning this work.

B. Damaged Earth: Verify that earth rendered unfit to receive planting due to concrete water, mortar, limewater, hydrocarbons or any other contaminant dumped on it has been removed and replaced with clean earth from a source approved by the Owner's Representative.

C. Examine the area and conditions under which the work in this section is to be performed. Verify that any existing irrigation system within the limit of work is in proper working order with full coverage. Correct conditions detrimental to the timely and proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected. Commencement of the work signifies acceptance of the existing conditions.

D. Protection:
1. Locate sewer, water, irrigation, gas, electric, phone and other pipelines or conduits and equipment within the area of work prior to commencing work.
2. Mark existing irrigation heads, valves, valve boxes and other below grade equipment or components that are scheduled to remain. Protect in place.

E. Runoff and Erosion Control: Furnish equipment, materials and labor necessary to control the flow, drainage, and accumulation of excess water running off the work area and prevent soil erosion, blowing soil and accumulation of wind-deposited material on the site per the approved SWPPP.

3.02 ROUGH GRADING, SOIL PREPARATION, PLANTER BACKFILL

A. Rough grading shall be performed by other subcontractors to the extent of establishing rough pads, slopes and drainage patterns. The Contractor is responsible for placement of topsoil and grading required to ensure positive drainage in all turfgrass and planting areas. All planting areas shall have a minimum topsoil depth of 18 inches from on-site native and/or approved import sources. Rough grading shall be completed prior to weed control, cross ripping or rock removal operations.

B. After the completion and acceptance of the weed control operations outlined below, and unless directed otherwise by the Landscape Architect or noted on the Drawings, and except for the area under the canopy of existing trees, the Contractor shall cross rip and till (break up large clumps and clods in excess of 2 inch diameter) the existing soil within all planting areas outside the canopy drip line of existing trees until the soil is loose and friable. Ripping shall be to a minimum depth of twelve inches (12") in turfgrass areas and eighteen inches (18") in shrub/ground cover areas, with ripping tines a maximum 18" apart performed in a minimum of two passes total in different perpendicular directions. The Contractor shall review the completed ripping operation with the Owner's Representative and Landscape Architect to determine compliance. The first 6 inches of any new topsoil fill shall be tilled into the existing soil to a minimum depth of 6 inches prior to placing any further topsoil fill. The Contractor shall provide any additional work as directed by the Owner's Representative after the review to obtain compliance. Do not proceed with the addition of topsoil and/or amendments, or commence rock picking or fine grading until the completed ripping operation is accepted in writing by the Owner's Representative.

C. Planting area soil under the canopy drip line of existing trees, or in planting beds not accessible by motorized equipment, shall be ripped to a minimum depth of 12 inches using manual spading shovels, forks and/or broadforks and working around major tree roots and/or utilities. In areas receiving new mulch, rip to a minimum depth of 4 inches while

protecting any existing plants and their root system. Break up and/or remove rocks and clods as indicated below.

D. Do not work soil when moisture content is so great that excessive compaction will occur, or when it is so dry that dust will form in air or clods will not break up readily, or when a full ripping depth cannot be achieved. Apply water, if necessary, to bring soil to an optimum moisture content for tilling and dust control. Maintain within 2 percent above or below optimum moisture content for the existing soil type at all times during the work.

E. After soil ripping and preliminary finish grading is completed, the topsoil shall be cleared of all concrete, wire, sticks, roots, debris and foreign materials. Remove native stones and clods as follows:
   1. In shrub/ground cover areas, remove stones and clods greater than one (1.0) inches in diameter from the top 3 inches of finish grade.
   2. In general, non-play or sport turfgrass areas, remove stones and clods greater than three-quarter (0.75) inch in diameter from the top 2 inches of finish grade.

F. Add clean planting topsoil where needed to bring grade to elevation to promote positive drainage. Spread approved planting topsoil over ripped subgrade prior to incorporating amendments.

G. Backfill all raised grade planters with a minimum depth of 18 inches of imported clean sandy loam planting topsoil conforming to Subsection 2.02 and approved prior to import and/or placement. Failure to obtain import approval prior to backfilling raised grade planters shall result in the removal of any planting and non-approved backfill, and the reinstallation of the work with approved materials.

3.03 WEED CONTROL

A. Weed control pesticides shall only be applied by an individual holding a valid Qualified Applicator Certificate (Category A) issued by the Department of Pesticides Regulation.

B. The Contractor shall treat any weeds in proposed new turfgrass and planting areas with a non-selective contact weed killer at the manufacturer's approved rates and procedures prior to any commencement of work at the site including any irrigation work, ripping of soils or fine grading. Areas planned for turfgrass seed/stolon planting shall in addition receive “grow and kill” weed removal as outlined below.

C. Weed eradication shall be ongoing throughout the course of the landscape installation. The Contractor shall apply a pre-emergent herbicide after shrub/ground cover planting and prior to mulch installation. Manually remove weed seed heads. At no time will weeds be allowed to become established. Contractor shall provide all weed control operations as directed by the Owner’s Representative.

D. All weed control operations using pesticides/herbicides shall comply with the CalDPR and Owner Standards, as well as AB2260 “Healthy Schools Act”. The Contractor shall comply with the notification and posting requirements of the “Healthy Schools Act”.
   1. The Contractor shall notify the Owner per Subsection 1.11, A.
   2. The Contractor shall post highly visible signs around the treatment area in conformance with the “Healthy Schools Act” warning of a scheduled pesticide/herbicide application a minimum of 24 hours before to 72 hours after a

pesticide application.

E. A non-selective contact herbicide for grassy weeds, '20% Vinegar Weed Slayer' by Good Natured, CA DPR Reg# 85208-1-AA-42177, shall be applied directly to the weed foliage. Only apply to dry surfaces, and a minimum of 8 hours before a rain event. Allow a minimum of 14 days from herbicide application to commence any planting.

F. Perform pre-plant clearing and weed control for native open ground areas planned to receive ~~turfgrass~~planting as follows:
1. Apply irrigation to encourage weed growth prior to ripping, and to maintain moisture in the soil.
2. Apply a contact herbicide to weed foliage. Remove weeds and expose bare soil.
3. Lightly disk/till to a depth of three-inches.
4. Perform a "grow and kill" operation after the first disking/tillage:
   a. Water and lightly fertilize to encourage weed germination.
   b. Follow with a second application of a contact herbicide.
   c. Remove weeds and perform a light harrowing or disking.
5. Apply irrigation to encourage weed growth. If additional weeds germinate, perform a second "grow and kill" operation.
6. Once existing weeds are completely removed, obtain authorization from the Owner's Representative to proceed with deep ripping, rock removal, soil conditioning and finish grading operations. Allow a minimum of 14 days from herbicide application to commence any planting.

G. After the shrub/ground cover planting is complete and prior to mulch installation, apply an approved pre-emergent herbicide per the manufacturer's recommended rates.

3.04 SOIL CONDITIONING

A. Before commencement of any soil conditioning, weed and rock removal shall be completed as outlined above.

B. Uniformly amend the entire area of topsoil in turfgrass and mixed planting areas per the following bid rates and per the approved modifications as a result of the soils analysis recommendations:
1. Turf and Non-Sloped (less than 4h:1v) Planting Area Soil Conditioning (per 1,000 square feet).
   a. Compost at a rate of six (6.0) cubic yards (a 2.0 inch thick layer).
   b. Gypsum at a rate of 100 pounds, or Sulfur at 19 pounds, or an equivalent combination.
   c. Humate soil conditioner at a rate of thirty (30) pounds.
   d. A pre-planting fertilizer to turfgrass areas at a rate of 1.25 pounds of actual P and K.
   e. A pre-planting fertilizer to mixed planting areas at a rate of 1 pound of actual N.
   f. Mycorrhizae per Subsection 3.06, Mycorrhizae Application.

C. Till soil amendments into the entire planting area soil to a minimum depth of six (6) inches. Perform the cultivation in at least two passes, one in each perpendicular directions to the first, so that the amendments are homogeneously incorporated into the topsoil. All

cultivation inside the dripline of existing trees shall be preformed manually with minimal disturbance to the root system.

D. Planting backfill for trees and shrubs shall be a mix of three parts native soil and one part Compost by volume. Add Humate at 2.0 pounds, and Mycorrhizae at 0.5 pounds per cubic yard of backfill.

E. Amendment material types and application rates may be subject to change based on the findings and recommendations of the horticultural soil testing lab, and as such may result in an increase or decrease in the Contract Amount.

3.05 FINE GRADING

A. Upon completion of soil preparation, fine grade all planting and turfgrass areas to a smooth and even slope conforming to and establishing drainage patterns per the approved Grading Plan. Grading shall eliminate all humps and hollows and promote positive drainage in all planting and turfgrass areas.

B. Where hardscape is installed in existing mixed planting areas, a minimum transition grade width of 2 feet adjacent to the edge of hardscape shall be constructed unless noted otherwise. The maximum slope of any transition grade in mixed planting areas shall be 20 percent (1v:5h). The area of transition grading shall be planted or repaired as specified herein.

C. Tolerance of grade differential for planting and general turfgrass areas shall be plus or minus 0.04 foot. If requested, the Contractor shall water test all turf and planting areas after the grading operations are completed in the presence of the Owner’s Representative and Landscape Architect. The water test shall consist of applying water to the turf and planting areas to the point where water begins to run over the soil to show the drainage pattern. Make all corrections to the finish grading as required by the Owner’s Representative to re-established positive drainage patterns. Acceptance of the finish grading shall be obtained in writing from the Owner’s Representative and Landscape Architect prior to proceeding with soil conditioning and planting operations.

D. Turfgrass sports fields shall be fine graded using a laser controlled machine capable of producing final grades within 0.02 foot plus or minus from the proposed elevations.

E. After the finish grading process, relative compaction of the soil in turf and planting areas shall range between 82% and 85% relative density. Compaction/moisture levels are generally acceptable if an Oakfield probe is able to penetrate a minimum of six inches into the cultivated planting topsoil with moderate pressure. The Owner reserves the right to require the Contractor to test for over compaction. If the compaction is within the acceptable range, the test will be paid for by the Owner. All testing due to non-compliance will be paid for by the Contractor.

F. Remove all rocks produced as a result of the soil conditioning and finish grading operations per the requirements of Subsection 3.02.

G. Finish grades shall be one-half inch (1/2") to three-quarter inch (3/4”) for turfgrass sod areas, flush (0.0”) for turfgrass seed/stolon areas and two inches (2") for shrub/ground cover planting areas below the finish surface of all adjacent walks, curbs, mowstrips and

utility/valve boxes or collars. Transition any non-compliant grade in existing turfgrass areas at a maximum 12h:1v slope to meet finish grades above, unless shown otherwise on the grading plan.

3.06 MYCORRHIZAE APPLICATION

A. In turfgrass planting areas, after fine grading is completed broadcast Mycorrhizae at a rate of one and one half (1.5) pounds per 1,000 square feet (65 lbs. per acre). Lightly rake into the top one inch (1") of topsoil immediately prior to turfgrass installation.

B. In shrub and/or ground cover planting areas, the Mycorrhizae inocculant shall be incorporated into the soil with the other soil amendments at five (5.0) pounds per 1,000 square feet (218 lbs. per acre) per Subsection 3.04, Soil Conditioning. Innocculant shall also be incorporated into the planting backfill per Subsection 3.04, E.

3.07 PLANTING

A. General Requirements
1. Obtain written approval from the Landscape Architect or Owner's Representative to begin planting operations. The irrigation system shall be fully automated and operational, all weeding, soil conditioning and finish grading completed, and the tree and plant layout approved.
2. Planting shall be performed by workmen familiar with planting procedures and under the supervision of a qualified foreman. The planting foreman shall be on the job site al all times when planting is in progress.
3. Planting operations shall not occur under unfavorable weather conditions.
4. Boxed trees shall be planted first. Shrub planting shall be completed before groundcover is planted.
5. Proceed and complete the landscape work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of planting required.
6. Cooperate with other contractors and trades working in and adjacent to the planting work areas. Examine drawings which show the development of the entire site and become familiar with the scope of other work required.

B. Planting Preparation and Operations
1. Planting material shall be provided with adequate protection of root system and balls from drying winds and sun. Do not bend or bind trees or shrubs in such a manner as to damage bark, break or destroy natural shape. Provide protective covering during delivery.
2. Deliver trees and shrubs after preparations for planting have been completed, and plant immediately. If planting is delayed more than six (6) hours after deliver, set trees and shrubs in shade, protect from weather and mechanical damage and keep roots moist. Do not remove container grown stock from containers until planting time.
3. All planting areas shall be smooth and even. Finish grades shall be done prior to any placement of plants.
4. Place all trees and shrubs in locations shown on the planting plan and obtain written field approval of the Landscape Architect before planting or digging planting pits. Inform the Landscape Architect seven (7) days prior to placing the plants. Maintain a minimum 15 foot clearance from trees to any light pole, unless specifically noted

otherwise.

5. Carefully remove all canned stock from containers with tin snips or approved cutter. Cut away and remove any girdled or matted roots.
6. Excavate holes of circular outline with vertical sides for all plants 15 gallon or less. Boxed trees shall have square planting holes. The vertical sides and bottom of the holes shall be thoroughly scarified to promote union of backfill with existing soils. All trees shall have two drainage sump holes drilled with a twelve inch (12") diameter auger penetrating hardpan layers to a minimum one (1) foot into a sand/gravel layer or to a minimum depth of ten (10) feet below the planting pit bottom. Precautions shall be exercised to avoid smooth sides on the holes. Offset augured holes a minimum of eighteen inches (18") from planned tree location to avoid settling of tree after planting.
7. After cleaning out the sump holes, the Contractor shall test the sumps for drainage by flooding with water. If the water does not drain out within twenty-four (24) hours, auger down as required to achieve such drainage by breaking through the hardpan layer, or by extending the drainage sumps to a minimum depth of 15 feet below the bottom of the planting pit. After obtaining approval of the sump holes, fill the augured drainage sump holes with coarse concrete sand.
8. Tree and shrub planting pits shall be at least two and one half (2.5) times the width of the plant container, but a minimum of 36” wide for trees and 18” wide for container shrubs. Planting pits shall be as deep as the soil depth in the container or box, less the additional height of the crown above the finish grade.
9. Set each plant in the center of the pit, plumb and straight. Set the crown of the plant at one inch (1") for shrubs, two inches (2”) for trees above finish grade. When 1/2 of the backfill mix has been placed, tamp-in, insert fertilizer (BEST PAKS as per Section 2.1B1) and allow no air pockets as remainder of backfill is added.
10. Compact soil around the rootball of all plants and thoroughly water in the entire backfill depth.
11. Excess soil from plant holes shall be cultivated and raked to a smooth outline.
12. Shrubs and groundcovers shall be installed in relation to walks and paving to allow for future growth without obstructing traffic with clearance as shown on the drawings.
13. All plants shall be set in watering basin which shall be as wide as the planting pit, but at least four feet (4') in diameter and four inches (4") deep for trees and two feet (2') in diameter and three inches (3") deep for shrubs and vines.
14. Ground cover plants shall be planted at the spacing noted on the drawings. Not more than fifteen minutes shall elapse from the time any groundcover plant is planted until it is watered.

C. Pruning: Prune plants in accordance with established horticultural practice. Shearing of any plants will not be acceptable. Tree pruning shall only be performed with the written approval of the Landscape Architect and under the direction of a certified arborist, and shall comply with ISA Pruning Standards (ANSI 300).

3.08 MULCH

A. Prior to any mulch application, perform weed control operations as specified herein.

B. Where mulch is to be installed in an existing planting area, breakup/till the existing soil in open areas around existing plantings to a minimum 4” depth per section 3.02, and adjust

finish grade adjacent to hardscape elements per section 3.05 where not prohibited by existing plantings.

C. Install a minimum 3” layer of mulch in all non-turf planting areas, except for slopes greater than 3h:1v and seeded areas. Install a minimum 2” layer of mulch in all areas receiving flatted plants.

D. Install a minimum 3” layer of wood mulch at a minimum 3’ radius from the tree trunk of all trees located in turfgrass areas. Provide a smooth finish grade transition to a 2 inch depth where the mulch meets the turfgrass, so that the top elevation of the mulch is flush to the turfgrass soil. Keep mulch off the trunk. For new trees in turfgrass areas, remove the watering berm just prior to the turfgrass planting but maintain the mulched area within the planting pit.

3.09 STAKING & GUYING

A. Trees shall be supported by two (2) tree stakes as shown on the drawings. Cut off the top of stakes damaged by installation or where the stake conflicts with canopy branches.

B. Stakes shall be set firmly in the ground outside the rootball and where possible set stakes perpendicular to the prevailing northwest wind.

C. Trees shall be tied to upright stakes loosely with tree ties (see planting detail). Remove the nursery stake.

D. Multi-trunked trees shall be guyed, or individual branches may be staked and loosely tied as shown on the Drawings.

3.10 ROOT BARRIER

A. Install root barrier along hardscape edges whenever the distance from the center of the trunk to the hardscape edge is less than eight (8) feet. Install per the planting details and manufacturers recommendations.

3.11 ARBOR GUARD

A. Install ArborGard+ on all newly planted tree trunks in turfgrass areas per manufacturer's recommendations.

~~3.12 TURFGRASS SOD~~

~~A. The area to be planted shall be finish graded to present a smooth and even surface free of humps and hollows and conforming to the finish grading plans. Where new sod is abutting existing turfgrass, fine grade to allow for the thickness of the new sod soil so that the new and existing sod grades are flush. Immediately prior to planting, the surface of the area to be planted shall be sufficiently loose and friable, with adequate moisture to receive the sod. Avoid laying sod on hot or dry soil.~~

~~B. Lay first strip of sod slabs along a straight line (use a string in irregular areas). Butt joints tightly. Do not overlap edges. On second strip, stagger head joints (similar to a running bond brick pattern). Use a sharp knife to cut sod in order to fit curves, edges, and sprinkler~~

~~heads.~~

~~C. Install with turf-tired machinery full width sections sod as delivered and flush to adjacent surfaces. Terminating sod edges shall be straight and at right angles to hardscape elements whenever possible.~~

~~D. As the sod is being installed, water the sod lightly to prevent drying out. Continue to lay sod and lightly water until installation is complete.~~

~~E. After laying sod, roll to eliminate irregularities and to form good contact between sod and soil. Avoid a too heavy roller or excessive initial watering which may cause roller marks.~~

~~F. Water the completed lawn surface thoroughly. Topsoil should be constantly moist for a minimum two inches deep. Repeat irrigating at regular intervals to keep sod moist until rooted. The areas shall not be watered to the extent of saturating the soil and causing "flotation" or "flowing" of the top surface of the soil. After water has once been applied, no portion of the planted areas shall be allowed to dry out during the entire maintenance period. After sod roots are established, decrease frequency and increase amount of water per application as necessary to maintain good soil moisture to a minimum 6" depth without standing water or excess runoff. The Contractor shall be responsible to monitor the site and alter the watering times and frequencies to meet site and climatic conditions.~~

~~G. Prior to the start of the maintenance period, fill all seam joint gaps greater than 1/8 inch and less than 0.5 inch with washed concrete sand. Fill any joint gaps of 0.5 inch or greater width with a minimum two foot long replacement sod section in order to achieve a tight joint.~~

~~H. Replace dead or distressed sod with equivalent material as directed by the Landscape Architect.~~

~~I. Do not install turfgrass inside the watering basin of new trees planted in turf areas, or within a 3' radius of existing tree trunks located in turf areas.~~

~~3.13~~3.12 CLEAN-UP AND REPAIR

A. All areas shall be maintained in a neat and orderly condition at all times. All reasonable precautions shall be taken to avoid damage to existing planting and structures. Disturbed and/or damaged areas, whether a part of this work or from the work of other trades, shall be restored to their original condition.

B. Plants and/or turfgrass shown to remain and damaged or removed by construction operations and/or utility/electrical/drainage lines shall be replaced with plants that match as closely as possible to the existing plant species, variety and size. The replacement turfgrass sod variety shall be the same as shown in the Planting Legend if for new work, or shall match the existing turfgrass variety where the turfgrass is existing. Adjust the finish grade so that the new turfgrass sod abuts flush to the existing turfgrass or to hardscape. The replacement plants and/or turfgrass sod shall be maintained as part of the original scope of work.

C. After the planting operations are completed, the Contractor shall remove all trash, excess soil, empty containers or any other debris accumulated by the work from the site. All

damage caused by the work shall be repaired at the Contractor's expense and the site shall be left in a neat and orderly condition to the satisfaction of the Owner.

~~3.14~~3.13 PRE-MAINTENANCE REVIEW

A. A general review will be held prior to the start of the maintenance period upon conclusion of the planting operations, irrigation system installation and after clean-up has occurred. The Owner's Representative shall be informed in writing a minimum of seven (7) working days prior to the time the work is ready for review in order to arrange a suitable time and date for such review.

B. At the time of review, Contractor shall have all planting areas free of weeds and neatly cultivated and fine graded. All plant basins shall be in good repair. All trees shall be properly staked and tied. All planting areas shall be clear of weeds.

~~C. The establishment of turfgrass is herein defined as being all work necessary to grow a full, healthy, uniform stand of smooth and even texture and grade with clean straight edges without weeds, distressed areas or bare spots, and has been mowed at least twice per the specifications. The establishment of turfgrass is further defined as being all work necessary to develop a minimum rooting depth of 2 inches into site soil.~~

~~D.~~C. Work requiring corrective action or replacement in the judgment of the Owner's Representative shall be performed within five (5) days after the inspection. Corrective work and materials replacement shall be in accordance with the drawings and specifications and shall be made by the Contractor at no cost to the Owner. A subsequent review shall then be arranged.

~~E.~~D. If after the review, the Landscape Architect is of the opinion that all the work has been performed as per the Contract Documents, and a uniform stand of healthy dense turfgrass has been established without weeds or bare spots, the Contractor will be given written notice that the maintenance period may begin.

~~3.15~~3.14 MAINTENANCE - GENERAL

A. After all work indicated on the drawings or herein specified has been completed, reviewed, and approved, and the turfgrass has been successfully established per the requirements below, the Contractor shall commence a ninety (90) calendar day maintenance period in which the Contractor shall continuously maintain all areas included in the contract during the progress of the work and throughout the maintenance period, or until Final Acceptance of the project, whichever is greater.

B. Establishment and maintenance work includes monitoring the site to control all watering, replanting, fertilizing, mulching, weeding, cultivating and mowing necessary to bring the planted areas to a healthy and vigorous growing condition, and any additional work needed to keep the areas neat, edged, weed and trash free, and attractive.

C. All trees, shrubs, ground cover shall be kept at optimum growing condition by watering weeding, replanting, fertilizing, cultivating, tree stake repair, spraying for diseases and insects, replace dead or dying materials, pruning as directed, maintaining proper grades of plants, and providing any other reasonable operations of maintenance and protection required for successful completion of the project.

D. Any date when the Contractor fails to adequately water, replace unsuitable planted areas and other work determined to be necessary by the Owner, will **NOT** be credited as part of the establishment/maintenance period.

~~E. No additional payment will be made for additional time necessary for turfgrass establishment. The maintenance period shall not start until all contract work has been completed and all close-out documents and materials have been submitted. Turfgrass will be considered weed-free if there is a maximum of one percent undesirable turfgrass species, and nine weeds or less per 50 square yards (one per 50 square feet).~~

~~F.~~E. During the progress of the maintenance period, the Contractor and the Owner's Representative shall conduct reviews at no less than 21 day intervals to determine that ongoing maintenance activities have been conducted by the Contractor. If in the opinion of the Owner, ongoing maintenance has not been conducted by the Contractor in a satisfactory manner the maintenance period shall be suspended. The Contractor shall provide remedial work as directed by the Owner's Representative to correct the found deficiencies and schedule another review. If after the subsequent review the work is deemed acceptable, the maintenance period shall resume.

~~3.16 MAINTENANCE - MOWING AND DRESSING~~

~~A. Turfgrass areas shall be mowed during the growing season a minimum of twice a week for warm-season varieties and a minimum of once a week for cool-season varieties, or at any time the grass reaches 1.4 times its mowing height. Turfgrass shall be edged weekly. The Contractor shall coordinate his watering and weed control schedules to accommodate his mowing schedule. If the Contractor is unable to mow the turf areas on the required day, he has until 5:00 pm of the next day to do the work. After that time, the Owner reserves the right to secure the services of an alternate mowing entity to perform the work. The cost for the alternate mowing will be deducted from monies owed to the Contractor. The Contractor will remain responsible to perform all scheduled mowings and maintenance of the site. The turfgrass shall be mowed and edged, and all trash and debris removed prior to Final Acceptance.~~

~~B. Thirty days after the start of the maintenance period, team sports fields shall be topdressed and dragged with USGA topdressing sand at a rate of 1.15 tons per 1,000 square feet (+0.25 inch depth). Drag and roll all topdressed turfgrass areas with a lightly weighted turf roller in order to provide a smooth and even mowing surface. Additional topdressing may be required later in the maintenance period if the finish grade planarity is not acceptable.~~

~~3.17~~3.15 MAINTENANCE - FERTILIZATION

~~A. The Contractor shall fertilize the warm-season turfgrass (Bermudagrass) at the start of the maintenance period and every twenty-eight (28) days with the turfgrass maintenance fertilizer at a rate of 0.75 lb. of actual N /1,000 s.f. and as modified by the soil fertility recommendations and as directed by the Landscape Architect. The Contractor shall continue the fertilizer applications until the established turf is accepted.~~

~~B. The Contractor shall fertilize the temporary cool-season turfgrass at the start of the maintenance period every twenty-eight (28) days with the turfgrass maintenance fertilizer at a rate of 0.5 lb. of actual N /1,000 s.f. and as modified by the soil fertility recommendations and as directed by the Landscape Architect. The Contractor shall~~

~~continue the fertilizer applications until the established temporary turf is accepted.~~

~~C. The Contractor shall fertilize the turfgrass areas during the last week of the maintenance period with the turfgrass maintenance slow-release N fertilizer (43-0-0) at a rate of three and one-half (3.5) lbs./1,000 s.f. and as modified by the soil fertility recommendations and as directed by the Landscape Architect.~~

~~D.~~A. The Contractor shall fertilize the non-turf planted areas during the last week of the maintenance period with the mixed pre-planting fertilizer (14-6-11.6) at a rate of six (6.0) lbs./1,000 s.f. and as modified by the soil fertility recommendations and approved by the Landscape Architect. The Contractor shall allow for at least two separate fertilizer formulation applications in each fertilization operation.

~~3.18~~3.16 MAINTENANCE – REPAIR AND WEEDING

A. Between the twenty-first (21) day and the twenty-eigth (28) day after turfgrass planting, the Contractor shall perform the following: replant all spots or areas where normal germination or growth is not evident; remove all rocks or other debris that would constitute a hindrance to mowing or cultivating; repair all damage done by his operations. Where poorly compacted trench backfill shows settlement, remove turfgrass or plants, fill all depressions and eroded channels with sufficient conditioned topsoil to raise to proper grade, compact lightly and replant the filled areas. Roll all planted or replanted turfgrass areas with a lightly weighted turf roller in order to provide a smooth and even mowing surface.

B. Visible weeds shall be removed at least weekly during the maintenance period. At the end of the maintenance period, all planting areas shall be without weeds. If weeds are present, the Contractor shall manually remove the weeds and shall then apply a granular, selective pre-emergent herbicide at manufacturer's approved rates. Coordinate application with the Owner's Representative and provide certificates of application to Owner's Representative. The turfgrass will be considered weed-free if there are 9 weeds or less per 50 square yards (one per 50 square feet).

~~3.19~~3.17 FINAL REVIEW

A. A Final Review will not be scheduled until all Close-out Documents and materials have been submitted and accepted.

B. A Final Review will be performed before the end of the Maintenance Period or upon the pending Final Acceptance of the work, whichever is earlier, provided all deficiencies revealed during the maintenance period have been corrected. If deficiencies have not been corrected by the end of the stated maintenance period, the Contractor shall continue to fully maintain the project at his own expense. After all deficiencies have been corrected, a Final Review will be held with the Landscape Architect, Owner's Representative, and Contractor.

C. Final Acceptance of turfgrass is contingent on a weed free, healthy uniform stand without dead, bare or distressed areas with a minimum rooting depth of five (5) inches into site soil.

D. If after the Final Review, the Landscape Architect and Owner's Representative are of the opinion that the work is acceptable and complete, the Contractor's maintenance

responsibility shall terminate on an agreed upon date.

~~3.20~~3.18 WARRANTY AND REPLACEMENT

A. All trees and plants provided under this Contract shall be guaranteed to be in good, healthy, disease/pest free and in a flourishing condition one growing year from the date of Final Acceptance of the work, provided the Owner maintains the plants properly and in accordance with accepted horticultural practices. Species and size of any tree and/or plant replacements, either prior to or after Final Acceptance, shall be equal to that of the same adjacent trees and/or plants at the time of replacement as determined by the Landscape Architect.

B. The Contractor shall be responsible to replace all lost plants due to theft, vandalism or any other preventable causes till Final Acceptance of the work by the Owner. Replacement trees and plants shall be planted as originally specified and detailed. Replacement trees and plants shall be guaranteed as specified above from the date of replacement. The maintenance period may be extended for a duration of not more than the original maintenance period duration for the establishment of replacement plants.

C. The Contractor shall be held responsible for repair and/or replacement of damages to new or existing improvements resulting from the defects or actions of trees, plants, materials, equipment or workmanship one year from the date of Final Acceptance or the Notice of Completion, whichever is later.

END OF SECTION

SECTION 32 92 19: HYDROSEED PLANTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, material, equipment and services necessary to provide all hydroseeding-mulching of non-turfgrass plants, complete and in place, as shown and specified in the plans and specifications.

B. Work includes:
1. Preparation and soil conditioning.
2. Hydroseeding
3. Application of mycorrhizal inoculum
4. Cleanup
5. Ninety day maintenance.

C. Related Work Specificed Elsewhere
1. Contract Drawings, Addenda, general provisions of the Contract, including General and Supplemental Conditions, and Division 1 Sections apply to work of this section.
2. Section 31 20 00 - Earthwork
3. Section 32 84 00 – Irrigation System
4. Section 32 90 00 – Landscape Planting

1.02 REFERENCES

A. Latest version of American Society for Testing and Materials (ASTM) standards: ASTM D 422. Standard Test Method for Particle-Size Analysis of Soils.

1.03 SUBMITTALS AND NOTIFICATIONS

A. Submit documentation within twenty five (25) days after award of Contract that all required seed is available. No substitutions may be made without approval of the Landscape Architect. Requests for substitutions due to unavailability must be made in writing.

B. Materials List and Quantities: A complete material list shall be submitted prior to performing any work. Material list shall include all hydromulches, binders, seed, etc. Submit proposed quantities of each of the materials.

C. Submit a one pound sample of each type of seed mix specified.
1. The sample shall be drawn from the same lots used for the seeding work.
2. Attach seed tags and Certificate copies for each lot of seed.

D. Submit invoices from material suppliers for all amendments, fertilizer, seed, plants, mulch and any other materials provided for the landscape installation. Submit tags from seed packaging indicating seed varieties, percent purity and percent germination minimums.

E. The Contractor shall notify the Landscape Architect in writing a minimum of 7 days prior to starting seeding work. The notice shall state the equipment to be used, the date and time

that operations will start, and the name of the person in the field who will be in charge of the work.

F. If work is interrupted for reasons other than inclement weather, the Contractor shall notify the Landscape Architect a minimum of 24 hours prior to the resumption of work

1.04 SOIL FERTILITY TEST

A. The Contractor shall provide and pay for a fertility analysis of the existing soil and any proposed import planting topsoil in the seeding area per Section 329000. The soil fertility test and analysis can be combined with the testing and analysis required in Section 329000.

1.05 STANDARDS

A. A Registered Seed Technologist shall have tested all seed for Minimum Percent Pure Live Seed (PLS) at a Certified Seed Laboratory within 18 months of delivery to the site. Provide PLS for each of the seed mix components.

B. Provide seed that meets or exceeds specifications of Federal, State, and County laws requiring inspection for plant disease or insect control.

C. Provide seed that is true to botanical name. In all cases, botanical names shall take precedence over common names.

D. The work of this section shall be performed by a single firm experienced in this work and holding a current California Contractor's A or C27 License.

E. Perform the work of this section in accordance with the best standards of practice for landscape work and under the continual supervision of a competent foreman capable of interpreting the drawings and specifications.

1.06 VERIFICATION OF DIMENSIONS AND QUANTITIES

A. All scaled dimensions are approximate. Before proceeding with any work, carefully check and verify all dimensions and quantities and immediately inform the Landscape Architect of any discrepancy between the drawings and/or specifications and actual conditions. No work shall be done in any area where there is any such discrepancy until the Landscape Architect has given approval for the work.

1.07 OBSERVATION SCHEDULE

A. Contractor shall be responsible for notifying the Owner's Representative in advance for the following observations:
   1. Seeding area layout review - 72 hours
   2. Seeding operations - 48 hours
   3. Seeding germination – 48 hours

B. Contractor shall be responsible for scheduling site observation visits with the Owner's Representative as work progresses. Failure to schedule required observations shall not relieve Contractor of responsibility for obtaining approvals. Work that must be redone to satisfy these requirements shall be done by Contractor at no cost to Owner.

C. Observations may be waived or combined at the discretion of the Owner’s Representative.

D. When someone other than the Owner’s Representative conducts site observations, the Contractor shall show evidence in writing of when and by whom these observations were made.

E. No site visits shall commence without adequate preparation or all items noted in previous Observation Reports either completed or remedied unless the Landscape Architect has waived such compliance. Failure to adequately prepare or accomplish previous punch list items shall make the Contractor responsible for reimbursing the Landscape Architect for the site visit at his current billing rates per hour plus transportation costs. No further inspections will be scheduled until this charge has been paid and received.

1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver all seed to the jobsite in unopened containers with legible identification labels. Each seed package shall have a complete seed test analysis attached, stating seed lot number, botanical species, dealer’s guarantee of percentage of Purity, Inert, Crop, and Weed, as well as Germination, test date, and certificate or stamp of release by a County Agriculture Commissioner.

B. Store seed material in shade and protect from weather or injury. Maintain in a dry condition, and at a consistent temperature. Landscape Architect may at any time reject seed not maintained in this condition.

C. Deliver non-seed products to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trademark, and conformance to state law. Protect material from damage or breakage. Immediately remove empty containers from site.

1.09 SAMPLES AND TESTS

A. Landscape Architect reserves the right to take and analyze samples of materials for conformity to specifications at any time.

B. Contractor shall furnish samples upon request by Landscape Architect.

C. Rejected materials shall be immediately removed from the site at the Contractor's expense.

D. Contractor shall pay cost of testing of materials that do not meet specifications.

1.10 WARRANTY AND REPLACEMENT

A. Contractor shall reseed any poorly or inadequately germinated areas until each area has germinated a full and healthy stand of the specified plant species.

PART 2 - PRODUCTS

2.01 SEED

A. Fresh, clean, new crop seed.
   1. For slurry applications: mechanically mix to specified proportions.

2.02 SOIL AMENDMENTS

A. Soil amendments shall be as described in Section 32 90 00 Landscape Planting.

B. Contractor shall provide all amendments recommended by Soils Report at no additional cost to Owner.

2.03 MYCORRHIZAL INOCULUM

A. Mycorrhizal inoculum shall consist of spores, mycelium, and mycorrhizal root fragments in a solid carrier suitable for handling by hydro-seeding or dry seeding equipment. The carrier shall be the material in which the inoculum was originally produced, and may include organic materials, vermiculite, perlite, calcined clay, or other approved materials consistent with mechanical application and with good plant growth.

B. Mycorrhizal fungal species shall be suitable for the pH of the soil at the planting site and for the use of the seeds being sown. If the inoculum consists of a mixture of species, no more than 20% of the claimed propagule count shall consist of fungal species known to be unsuitable for the pH of the soil at the planting site.

C. Mycorrhizal inoculum is a live material. It shall be stored, transported and applied at temperatures of greater than 40º F and lesser than 90º F.

D. Inoculum shall have a guarantee of at least 220 live propagules per kilogram (100 live propagules per pound).

2.04 HYDROSEEDING FERTILIZER AND CONDITIONER

A. Bid Item: Water soluble fertilizer, Tri-C 6-2-4 with 20% Humate.

B. Soil additives and fertilizers will be as recommended by the required Soils Test.

2.05 FIBER MULCH

A. Fiber mulch shall be derived from recycled newsprint paper and dyed green (Enviro Fiber S-100 Hydroseeding Mulch, or equal).

B. Wood fiber mulch is not acceptable.

2.06 TACKIFIER

A. The tackifier shall be organic hydromulching tackifier additive composed of finely ground muciloid outer layer of a seed (Ecology Controls M-Binder or equal).

PART 3 - EXECUTION

3.01 INSPECTION AND ORGANIZATION

A. Site acceptance:
   1. The Contractor shall be responsible for verifying grades and site conditions before beginning work.

2. No change in Contract price will be allowed for actual or claimed discrepancy between existing grade and those shown on the plan after Contractor has accepted existing grades and moved on the site.
3. The Contractor shall be responsible for any damage to seedlings after installation prior to acceptance by Owner.

B. Scheduling: Perform seeding only when weather and soil conditions are suitable, as approved by Landscape Architect.
1. Finish grading and storm drainage improvements shall be complete prior to seeding.
2. The irrigation system, if applicable, shall be operational and coverage approved prior to seeding.
3. In areas where applicable, install trees and shrubs prior to seeding.

3.02 AREA PREPARATION

A. Topsoil shall not be stripped and shall remain in place.

B. Complete clearing and grubbing to the Owner's Representative's satisfaction. Prior to seeding, the seeding area shall be free of large stones, sticks, stumps, or other deleterious matter one inch in diameter or larger, and shall be free from all wire, plaster, construction debris of any kind, or similar objects that would be a hindrance to seeding or maintenance.

C. Stage the clearing work in areas small enough to insure that seed application will take place before any significant soil erosion will occur. The Contractor shall be responsible for preventing and repairing any soil erosion that occurs during the area preparation.

D. Clearing and weed control (level areas or slopes five to one (5h:1v) or less) - Approximately 4-6 weeks are needed to complete proper weed abatement. December through February are preferred months for this operation. Schedule may be extended or adjusted depending on weather conditions: colder temperatures and rainfall can add several weeks to the effectiveness of the work.
1. Apply irrigation to encourage weed growth prior to clearing, and to maintain moisture in the soil.
2. Clear weed growth by the application of a contact herbicide to all level areas after seasonal rains and overhead irrigation has helped germinate weed seeds and 3" to 4" of vegetative growth has occurred. Apply contact herbicide thoroughly to all plants per Manufacturer's guidelines.
3. Inspect weed kill progress for 1-2 weeks. Remove dead vegetation where weed kill is successful and rake to remove excess foliage to expose bare soil.
4. Lightly disk bare soil to a depth of three-inches, followed by a light roller.
5. After the first disking operation:
   a. Incorporate any required soil amendments and irrigate to encourage weed germination.
   b. Follow with a second light harrowing or disking the soil to a depth of 3" to kill any subsequent weeds.
6. A heavy roller should be used behind the disc. The second disking ("grow and kill") may also be the final seedbed preparation if seeding immediately follows.
7. If the seeding operation does not take place immediately, prepare the seed bed immediately prior to seeding by lightly tilling or disking the soil to a depth of 3" followed by a heavy roller.

E. Apply soil amendments at the rates specified in Section 329000 and as modified by the written approval of the Soils Report recommendations. Till into the top 6” of topsoil with a minimum of two passes in perpendicular directions. Finish grade to a +/- 1/2” tolerance over a 10’ length, with straight grades to drainage and/or hardscape improvements, and as specified in Section 329000.

F. Prior to seeding, make light applications of irrigation in order to achieve the optimum germination moisture level in the soil.

G. Contractor shall be responsible for finish grading all seeding areas as indicated on plans or as directed by Landscape Architect. Site preparation is to be reviewed by the Landscape Architect before seed application may begin.

3.03 MYCORRHIZAL INOCULUM APPLICATION

A. Application of mycorrhizal inoculum by hydroseed equipment shall be applied at the rate of 67 kilograms per hectare (60 lb. per acre).
   1. Mycorrhizal inoculum shall be applied in the same application as the seeds. In no case shall Mycorrhizal inoculum be applied after the seeds. The slurry must be applied within one hour of the seed and inoculum being added to the mixing tank.
   2. Do not add the inoculum to the mixing tank when slurry temperatures exceed 90º F.

3.04 HYDROSEED APPLICATION

A. The hydroseed slurry shall be applied in a one step process directly to the soil surface.
   1. Prepare and apply slurries in the proportions and quantities stated on the contract drawings.
   2. Slurry preparation shall take place at the work site and shall begin by adding water to the tank when the engine is at half throttle.
   3. Equipment:
      a. Hydraulic equipment used for the application of the seed and slurry mixture shall have a built-in agitation system and operating capacity sufficient to agitate, suspend and homogeneously mix a slurry containing not less than 40 lbs. of fiber mulch plus a combined total of 7 lbs. additive solids for each 100 gallons of water.
      b. The slurry distribution lines shall be large enough to prevent clogging and shall be equipped with a set of hydraulic spray nozzles that will provide a continuous non-fluctuating discharge.
   4. The operator shall spray with a uniform visible coat, using the color of the applied slurry as a guide. Apply the slurry in the correct amount to distribute the specified quantities over the specified areas.
   5. All slurry mixture which has not been applied within two hours after mixing will be rejected and removed from the project and disposed at the Contractor's expense.
   6. The Contractor shall exercise special care to prevent any of the slurry from being sprayed outside the designated areas. Any slurry spilled into restricted areas shall be cleaned up at the Contractor's expense to the satisfaction of the Owner’s Representative.
   7. Immediately following application of the hydroseed mixture, the Contractor shall wash excess material from trees, shrubs, fences, valve boxes, equipment markers, or other site features. Care shall be exercised to avoid washing or eroding mulch materials from the area.

B. Apply the fiber mulch in the hydroseed slurry at a rate of 2,000 pounds per acre for slopes greater than 5h:1v; 1,500 pounds per acre for level areas and slopes less than 5h:1v.

C. Apply the tackifier in the hydroseed slurry at a rate of 100 pounds per acre.

3.05 GERMINATION

A. It shall be the responsibility of the Contractor to operate and manage the irrigation system to achieve proper germination of the seed after application. Refer to Irrigation System specifications.

3.06 RESEEDING

A. The Contractor shall reseed bare spots failing to adequately germinate an adequate number of plants within 14 days.
   1. The Landscape Architect shall be the sole judge of adequacy of coverage.
   2. The Contractor shall remain responsible for reseeding until the Landscape Architect approves seed application and germination.

3.07 MAINTENANCE

A. Manually remove weeds and trash debris on a minimum weekly basis throughout the maintenance period.

3.08 CLEANUP

A. After all seeding operations have been completed, remove all trash, empty containers and rubbish from the property and dispose of legally. All scars, ruts, or other marks in the ground caused by this work shall be repaired and the ground left in a smooth condition throughout the site. The Contractor shall sweep the site and shall wash down all paved areas within the Contract area, leaving the premises in a clean condition.

END OF SECTION

SECTION 334000 - STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This section includes the following:

1. Provide all materials, labor, equipment and services necessary to furnish and install Storm Drainage System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.

B. RELATED SECTIONS:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions 00 and 01 sections, apply to this work.
2. Section 31 23 33 – Trench Excavation and Backfilling

1.3 REFERENCES

A. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

B. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

C. ANSI/ASTM C478 - Precast Reinforced Concrete Manhole Sections.

D. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

1.4 DEFINITIONS

A. Bedding: Fill placed under, around, beside and directly over pipe, prior to subsequent backfill operations.

B. Utility: Any buried or above ground pipe, conduit, cable, associate device or appurtenances, or substructure pertaining thereto.

1.5 SUBMITTALS

A. Submit under provisions of Division 01.

B. Certificates of compliance for material.

C. Product Data: Provide data indicating pipe, accessories, and associated equipment to be furnished.

D. Submit manufacturer's data and/or fabrication drawings for all pipes, and appurtenances installed under this Section. No items shall be incorporated into the work until submittals are approved by the Architect/Engineer

1.6 COORDINATION

A. Coordinate work with Owner’s personnel.

B. Verify that the location of existing utilities have been indicated at work site by utility authorities and Owner’s personnel.

C. Coordinate work with other project work.

1.7 EXISTING UTILITIES

A. The Engineer has made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

B. Service laterals and appurtenances have also been shown where information was available as to their location. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

C. At new work location, expose by hand methods all existing utilities along the route of the new work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand methods to locate all existing facilities as indicated on the plans, and as indicated at the work site by Owner’s personnel.

D. Maintain all existing utility mains and service lines in constant service during construction of the Work

1.8 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01.

B. Accurately record actual locations of utilities encountered.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforced Concrete Pipe for pipe larger than fifteen (15) inches: ANSI/ASTM C76, Class 3, with rubber gasket joints per ANSI/ASTM C443.

B. Storm drainage sewer pipeline shall be polyvinyl chloride (PVC) pipe for storm sewer conforming to ASTM designation 3034, SDR 35, with elastomeric gasket joints per ASTM D 3212 for pipe fifteen (15) inches or less.

C. Storm drainage pipeline shall be polyvinyl chloride (PVC) pipe for storm sewer conforming to ASTM D1785, Schedule 40, for pipe three (3) inches or less.

D. Poured in Place Concrete: Specification Section SITE CONCRETE IMPROVEMENTS.

E. Mortar: Composed of one part, by weight, portland cement (Type II low alkali per ASTM C150), 2 parts, by weight, sand, and water.

F. Manhole Frames, Covers and Grates: Cast Iron per ASTM A48, Class 25.

G. Soil Fill for Concrete Pipe Bedding Envelope: Specification Section TRENCH EXCAVATION AND BACKFILL.

H. Catch basins and drain inlets shall be constructed as per detail drawing.

I. Concrete collar shall be constructed as per detail drawing.

J. Cleanout shall be precast concrete with cast iron lid marked for service Christy G5 or approved equal and constructed as per detail drawing.

K. All metallic pipe, fittings and appurtenances in contact with soil shall be coated or wrapped with an approved material, as required to protect it from corrosive soil.

L. Locator Tape: Tape shall be an inert material such as polyethylene plastic with a metallic core, and highly resistant to alkalis, acids, or other chemical components likely to be encountered in soils. The tape shall be bright colors for contrast with the soils with identifying print in black letters. The tape shall be six inches wide and be printed “CAUTION – STORM SEWER LINE BELOW”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions.

3.2 PREPARATION

A. Identify location of proposed storm drainage facilities to be constructed. Expose connection points to existing system.

B. Locate, identify, and protect existing above and below grade utilities from damage.

C. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.

D. Protect existing structures and other improvements to remain from damage from excavation equipment and vehicular traffic.

E. Employ equipment and methods appropriate to the work site.

F. Protect excavated areas from drainage inflow, and provide drainage to all excavated areas. Dewater existing drainage basins and existing drainage pipeline systems as necessary to accomplish the work.

G. Comply with safety requirements as they pertain to excavations, per Specification Section EARTHWORK.

H. Remove all interfering surface and subsurface improvements authorized for removal.

3.3 EXCAVATION

A. Excavate soil required to locate existing utilities and install the work.

B. Excavate trenches and pits per Specification Section EARTHWORK.

C. Excavate trenches and pits to allow installation and construction of the storm drainage facilities to the alignment, grades, depths and cross-sections as indicated on the construction plans.

D. Excavate trench to depth which is 6 inches below the outside bottom of the pipe barrel to be placed therein.

E. Cut trenches just wide enough to allow the installation of the pipe and pipe bedding as indicated on the plans. Minimize trench width above the pipe.

F. Provide protection to public per Division 01.

3.4 INSTALLATION AND BEDDING OF STORM DRAIN PIPE

A. Install the pipe and fittings to the lines and grades shown on the construction plans.

B. Install pipe and fittings in accordance with the manufacturer's recommendations, and these specifications.

C. Unless otherwise approved by the Engineer, lay all pipe upgrade from structure to structure, with bell or socket ends of pipe upgrade.

D. Excavate suitable bell (or socket) holes in the bedding material, so that the bells do not bear on the subgrade or bedding. Provide uniform bearing of pipe barrel on bedding material.

E. Ensure that all joints are properly "homed" and are watertight.

F. Bed concrete pipe in backfill or sandfill soil envelope, and compact to a minimum of 90% relative compaction. Place and compact the bedding material under, around and over the pipe, filling the trench cavity and extending from the bottom of the trench (6 inches below the outside bottom of the pipe barrel) to a level 12 inches above the outside top of the pipe barrel.

3.5 INSTALLATION OF STORM DRAINAGE STRUCTURES AND APPURTANCANCES

A. Install storm drainage structures as indicated on the construction plans, in accordance with the manufacturer's recommendations, and as specified herein.

B. Construct poured-in-place concrete per Specification Section SITE CONCRETE IMPROVEMENTS.

C. Key top of poured-in-place concrete bases for structures to receive the tongue of precast riser sections.

D. Construct cleanout, outfall structure per detail drawing.

3.6 BACKFILLING TO FINISHED GRADE AND FINISHED GRADING

A. Place and compact backfill per Specification Section TRENCH EXCAVATION AND BACKFILL.

B. Conform finished surface to the lines, grades and cross-sections shown on the plans, or as otherwise directed by the Inspector.

C. In areas to receive paving or a significant thickness of sealing material, temporarily set manhole frame and cover below finish grade, then return after final surfacing and/or pavement sealing and bring manhole frame and cover to final grade, as shown on the plans.

D. Fine grade all finished soil surfaces disturbed to the lines, grades and cross-sections shown on the plans.

E. Rake and smooth all finished dirt surfaces.

3.7 TOLERANCES

A. Pipe laying tolerances:
1. Above grade: Not to exceed 1/4-inch above planned grade.
2. Below grade: Not to exceed 1/2-inch below planned grade.
3. Alignment: Not to exceed 2 inches from planned alignment, if gradual and regular over a distance of 20 feet.

B. Structure finish grade tolerance: Within 1/4 inch of planned grade, but must match adjacent improvements.

3.8 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 01.

B. Compaction testing of bedding and backfill will be performed in accordance with ASTM D 1557.

C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest at no additional cost to Owner.

END OF SECTION

Leon Environmental Services

Richard "Danny" Leon CAC # 04-3708
Tommy Leon CAC # 05-3882

February 23, 2022

Marcus J. Metcalf
Merced Community College District
3600 M. Street
Merced, CA 95348

Re: Asbestos and Lead Limited Survey
Merced College – Plant Science Building
3600 M. Street
Merced, CA
Job No. C26-22

Dear Marcus:

Attached is the Asbestos and Lead Limited Survey Report for the above referenced site. The report includes inspection observations; a list of all samples taken, bulk sample analysis results, and recommendations concerning Asbestos and Lead identified at this site.

If you have any questions or need additional information, please do not hesitate to call. Thank you for using Leon Environmental Services. We look forward to working with you in the future.

Respectfully yours,

Tommy Leon
Certified Asbestos Consultant
Certification No. 05-3882
CDPH Supervisor / Inspector Assessor
Lead Inspector Assessor # LRC-00002505

4545 N. Brawley Ave., Suite 104, Fresno, CA 93722
Phone: 559.274.9200 Fax: 559.274.9240 Email: LeonEnviro@comcast.net

<u>Asbestos and Lead Limited Survey</u>: Merced College Plant Science Bldg., 3600 M. Street, Merced, CA
C26-22

ASBESTOS ANALYSIS RESULTS

A total of **21** samples of suspect materials were collected by a state certified asbestos inspector at **3600 M. Street, Merced, CA**. The sample collection areas were determined by the information given to the inspector by **Marcus J. Metcalf** about the impending remodel/renovation that is planned for this building. Western Analytical Laboratory, Inc., a NVLAP accredited laboratory performed a total of **21** analyses from **21** samples collected. The chain of custody from Leon Environmental Services and the report from Western Analytical contains a full list of all samples taken from this site.

Sample	Location	Material	% Of ACM	Friable
18	Green House Exterior Wall	Transite Siding	5%	No

ASBESTOS COMMENTS AND RECOMMENDATIONS

Non-Friable Asbestos

<u>The Transite Siding</u> (samples 18) located on the lower exterior wall of the green house is positive for asbestos at 5%.

These materials are considered a ***non-hazardous non-friable ACM***. It is required that a licensed asbestos abatement contractor remove these materials prior to renovation and or demolition of this structure.

ASBESTOS CONCLUSIONS AND REGULATIONS

US EPA NESHAP (40 CFR Part 61)

Based on our survey, sampling and subsequent laboratory analysis and regulatory guidelines affecting this site, the types of ACM identified on the previous page require removal (in most cases) prior to demolition and/or renovation procedures to comply with local, state and federal agencies. The US EPA NESHAP (40 CFR Part 61 – November 20, 1990) requires materials containing greater than one percent asbestos be removed prior to renovation or demolition. If those materials are friable or likely to become friable due to the forces expected to act upon them during renovation or demolition, they become a regulated asbestos containing material (RACM) and require a 10-day notification to the local Air Pollution Control District prior to abatement.

Non-friable and non-regulated ACM, in most cases, may be disposed of as a Non-Hazardous waste in a landfill that accepts Asbestos Containing Materials. All friable waste containing more than 1% asbestos (RACM) should be manifested as hazardous waste for disposal purposes.

CAL OSHA--------Construction Industry--------8CCR, 1529

Cal/OSHA worker health and safety regulations apply during any disturbance of ACM by a person while in the employ of another. This is true regardless of friability or quantity disturbed. If there is greater than 100 square feet of ACM which will be affected by the demolition, a California Licensed Contractor who is registered with Cal/OSHA for asbestos is required. The regulations regarding asbestos are found in Title 8 CCR Section 1529, and also include formal notification requirements to Cal/OSHA at least 24 hours prior to removal. It is required that removal be conducted with the material kept in a wetted state to contain dust and hazardous emissions.

The construction industry standard covers employees engaged in demolition and construction, and the following related activities likely to involve asbestos exposure: removal, encapsulation, alteration, repair, maintenance, insulation, spill emergency cleanup, transportation, disposal and storage of ACM.

Demolition contractors typically require that a building owner/operator accept responsibility for removal of all ACM found during the building inspection prior to start of demolition activities.

LEAD BASED PAINT XRF ANALYSIS RESULTS

The sample collection areas were determined by the information given to the inspector by **Marcus J. Metcalf** about the impending remodel/renovation that is planned for this building. All paint samples were analyzed HUD Guidelines by XRF.

Sample	Sample Location	Type	Substrate	Color	XRF Result (mg/cm^2)	LBP
07	North Wall	Paint	Metal	Beige	0	No
08	North Door	Paint	Metal	Beige	0	No
09	North Door Frame	Paint	Metal	Beige	0.1	No
10	East Door Frame	Paint	Metal	Beige	0.2	No
11	East Door	Paint	Metal	Beige	0.1	No
12	East Wall	Paint	Metal	Beige	0.1	No
13	East Wall	Paint	Metal	Beige	0.1	No
14	East Door	Paint	Metal	Beige	0.1	No
15	East Door Frame	Paint	Metal	Beige	0.1	No

16	East Door Frame	Paint	Metal	Beige	0.2	No
17	East Door	Paint	Metal	Beige	0	No
18	South Wall	Paint	Metal	Beige	0	No
19	South Wall	Paint	Metal	Beige	0	No
20	West Wall	Paint	Metal	Beige	-0.1	No
21	West Door Frame	Paint	Metal	Beige	0.2	No
22	West Door	Paint	Metal	Green	0	No
23	West Door	Paint	Metal	Green	0	No
24	West Door Frame	Paint	Metal	Beige	0.2	No
25	West Wall	Paint	Metal	Beige	0.1	No
26	West Door	Paint	Metal	Beige	0	No
27	West Door Frame	Paint	Metal	Beige	0.1	No
28	South Door Frame	Paint	Metal	Beige	0.1	No
29	South Door Frame	Paint	Metal	Beige	0.1	No
30	East Door Frame	Paint	Metal	Beige	0.2	No
31	North Eave	Paint	Metal	Red	0.3	No
32	East Eave	Paint	Metal	Red	0.4	No
33	West Eave	Paint	Metal	Red	0.3	No

All paint samples tested for this survey were below the 1.0 mg/cm² level by XRF established by HUD to be considered a Lead Based Paint (LBP). All homes built prior to 1978 are assumed to contain Lead Based Paint. Although limited paint chip samples came back negative for Lead, Lead safe work practices should be in place during any construction or demolition that would affect these areas.

LEAD BASED PAINT CHIP ANALYSIS RESULTS

A total of 03 paint chip samples were collected by a state certified Lead Inspector. The sample collection areas were determined by the information given to the inspector by **Marcus J. Metcalf** about the impending remodel/renovation that is planned for this

building. All lead paint samples were analyzed by Atomic Absorption via EPA method SW-846 7420M by EMLab Inc. Results are reported in percent by weight.

Sample	Sample Location	Material	Reporting Limit	%PB By Weight	LBP
L01	Women's Restroom Floor	Ceramic Tile	0.004	BRL	No
L02	Women's Restroom Wall	Ceramic Tile	0.004	0.041	No
L03	Men's Restroom Wall	Ceramic Tile	0.004	0.017	No

BRL – Below Reportable Limits

All paint chip samples tested for this survey were lower than the 0.5% by weight level established by HUD to be considered a Lead Based Paint (LBP). All homes built prior to 1978 are assumed to contain Lead Based Paint. Although limited paint chip samples came back negative for Lead, Lead safe work practices should be in place during any construction or demolition that would affect these areas.

LBP COMMENTS AND RECOMMENDATIONS

The federal and CALOSHA regulations for lead in construction do not specify a level of a lead in paint that classifies it as LBP. However, federal and state OSHA regulations specify ***airborne lead levels*** that should not be exceeded during construction without appropriate protection and training.

The action level for lead is 30 micrograms per cubic meter of air (µg/m³) and the permissible exposure limit (PEL) is 50µg/m³. These airborne lead levels can be exceeded during construction or demolition activities such as scraping, sanding, grinding, blasting, and torching LBP surfaces, even when levels of lead in paint are far below the HUD definition of LBP of 1.0 mg/cm² or 0.5 percent lead by weight. OSHA Lead in Construction Standard Cal/OSHA 8 CCR 1532.1 shall apply whenever construction work is conducted where employees may be exposed to lead.

Beginning April 2010, new federal law **(EPA RRP rule)** will require that contractors performing renovation, repair and painting projects that disturb lead-based paint in homes, child care facilities and schools built before 1978 that a child under age six visits regularly to be certified and follow specific work practices to prevent lead contamination. Also, beginning April 2010, federal law will require contractors that disturb lead-based paint in homes, child care facilities and schools, built before 1978 to be certified and follow specific work practices to prevent lead contamination.

LBP Conclusions and Regulations

The Department of Housing and Urban Development (HUD) considers a paint to be a lead-based paint hazard when the content of the paint exceeds 0.5% or 5000ppm. California Occupational Safety and Health (OSHA) regulations require employee personnel monitoring at any detectable levels until statistically reliable results indicate that exposure will remain consistently below the OSHA Action Level of 30 micrograms/m^3 and the Permissible Exposure Level of 50 micrograms/m^3 for an 8 hour day. The employer must then produce a "Negative Exposure Assessment" to indicate that it is not possible with the specific lead-based paint product to create excessive lead exposure levels.

Limitations of Liability

Conclusions and recommendations presented in this report are qualitative judgments based on the prevailing regulations and accepted industry standards at the time of the report issuance. Leon Environmental Services provides no other guarantees, either expressed or implied. All quantities of materials listed herein are estimates for sampling purposes only, and should be verified by Owner representative or an abatement / demolition contractor prior to asbestos abatement or demolition.

The nature of demolition is such that materials can be uncovered which previously were unknown to exist. Therefore, Leon Environmental Services cannot be responsible for materials not previously detected due to lack of accessibility or concealment, although every effort was made during the inspection to detect all suspect materials. If any suspect materials other than those included herein are discovered during renovation or demolition, it must be assumed that the materials are asbestos containing, and should be treated accordingly until further testing and analysis is performed.

The data interpretations and recommendations are based solely on information available to Leon Environmental Services at the time of our inspection. The customer recognizes that site conditions or accessibility may vary, from those encountered at the time of our inspection and sample collection. Varying conditions or access could result in additional information that would lead us to revise conclusions and recommendations. Leon Environmental Services will not be responsible for the interpretation or use by others of information contained within this report.

Thomas M. Leon

Digitally signed by Thomas M. Leon
DN: cn=Thomas M. Leon, o=Leon Environmental Services, ou, email=leonenviro@comcast.net, c=US
Date: 2022.02.24 16:38:46 -08'00'

Thomas Leon Date
Certified Asbestos Consultant
Certification No. 05-3882
State of California Department of Public Health
Lead Inspector Assessor # LRC-00002505

<u>Asbestos and Lead Limited Survey</u>: Merced College Plant Science Bldg., 3600 M. Street, Merced, CA
C26-22

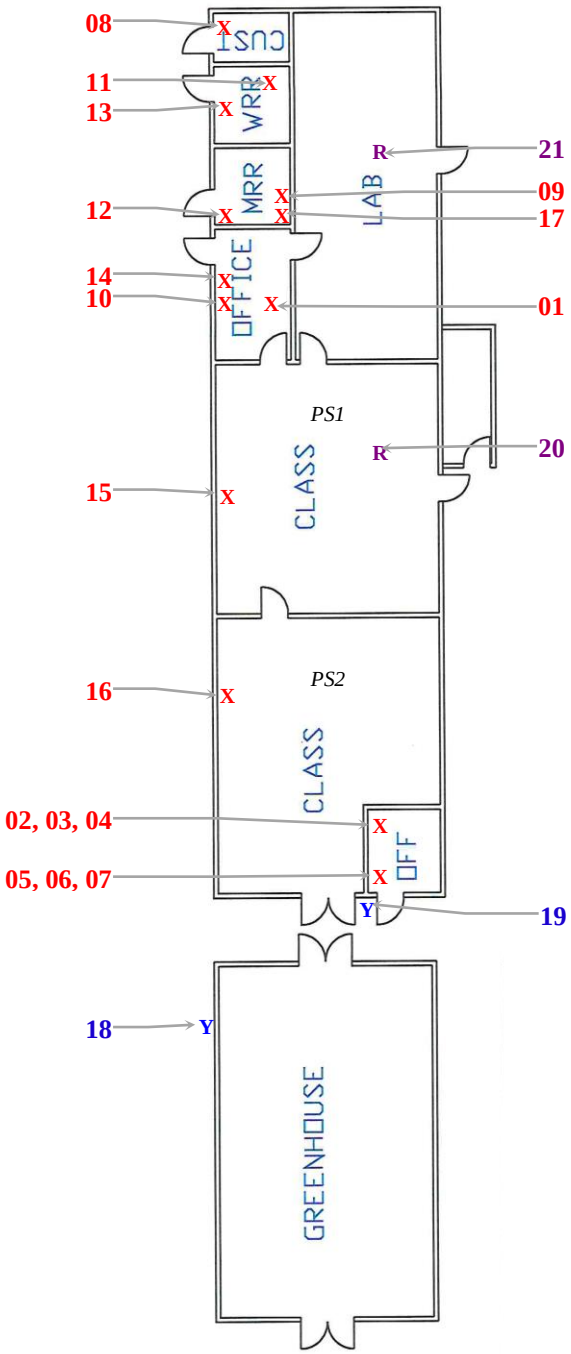
*Abbreviation Key:

Asbestos Containing Material — ACM (equal to or greater than 0.1% by weight)
Vinyl Asbestos Tile – VAT
No Asbestos Detected--N.A.D or N.D.
Homogeneous—H
Not Sampled—NS

Leon Environmental Services

Richard "Danny" Leon CAC Certification No. 04-3708
Tommy Leon CAC Certification No. 05-3882

Job C26-22 / Sample Location Diagram
Merced College – Plant Science Building / 3600 M Street, Merced, CA
Marcus J. Metcalf / Merced Community College District
Drawing not to Scale



Y = Exterior Samples
X = Interior Samples
R = Roof Samples

4545 N. Brawley Ave., Suite 104, Fresno, CA 93722
Phone: 559.274.9200 Fax: 559.274.9240 Email: LeonEnviro@comcast.net

N

Leon Environmental Services

4545 N. Brawley Ave., Suite 104, Fresno, CA 93722 Phone: 559.274.9200 Fax: 559.274.9240 Email: LeonEnviro@comcast.net 155-522

Customer: Marcus J. Metcalf **Company:** Merced Community College District

Date: February 16, 2022 **Job No.** C26-22

Analysis (PLM) **Turn Around:** 2hr Rush Same Day (24hr) 48hr 3-5 days

Inspection Site : Merced College - Plant Science Building: 3600 M Street, Merced, CA

Sample No	Location	Material			Quantity
		Color	Type	Friable	
01	North Office (PS1A) Floor		Carpet Glue		
02	South Office (PS2A) Wall		Texture/Paint		
03	South Office (PS2A) Wall		Joint Compound		
04	South Office (PS2A) Wall		Sheetrock		
05	South Office (PS2A) Wall		Texture/Paint		
06	South Office (PS2A) Wall		Joint Compound		
07	South Office (PS2A) Wall		Sheetrock		
08	Custodial Room Wall		Sheetrock		
09	Men's Restroom Wall	Brown	Sheetrock		
10	North Office (PS1A) Wall		Wallpaper		
11	Women's Restroom Wall		Ceramic Tile Adhesive		
12	Men's Restroom Wall		Wall Tile Grout		
13	Women's Restroom Floor		Ceramic Tile Grout		
14	North Office (PS1A) Wall		Basecove Mastic		
15	Classroom #2 (PS1) Wall		Basecove Mastic		
16	Classroom #1 (PS2) Ceiling		2'x4' Ceiling Panel		
17	Men's Restroom Ceiling		2'x4' Ceiling Panel		
18	Green House Exterior Wall		Wall Paneling		
19	Foundation		Concrete		
20	Roof		Roof Mastic		

Relinquished By Tony Leon Date 2-16-22

Received By Date 2/17/22

Leon Environmental Services

4545 N. Brawley Ave., Suite 104, Fresno, CA 93722 Phone: 559.274.9200 Fax: 559.274.9240 Email: LeonEnviro@comcast.net

Customer: Marcus J. Metcalf **Company:** Merced Community College District

Date: February 16, 2022 **Job No.** C26-22

Analysis (PLM) **Turn Around:** 2hr Rush Same Day (24hr) 48hr 3-5 days

Inspection Site : Merced College - Plant Science Building: 3600 M Street, Merced, CA

Sample No	Location	Material			Quantity
		Color	Type	Friable	
21	Roof Ducting		Duct Tape Sealant		

Relinquished By Tony Leon **Date** 2-16-22

Received By [signature] **Date** 2/17/22

WESTERN ANALYTICAL LABORATORY, Inc.
TEST REPORT

NVLAP TESTING
NVLAP LAB CODE 200037

REPORT NO:	155-5222	CLIENT:	Leon Environmental Services 4545 N. Brawley Ave., Suite 104 Fresno CA 93722
DATE COLLECTED:	February 16, 2022		
DATE RECEIVED:	February 17, 2022	ATTENTION:	Danny Leon (CAC# 04-3708)
DATE REQUIRED:	February 18, 2022	REFERENCE:	C26-22 Marcus J. Metcalf – Merced Community College District Merced College - Plant Science Bldg. 3600 M Street, Merced, CA

SUBJECT: Polarized Light Microscopy Analysis for Asbestos; 21 samples

METHODOLOGY: "Method for the Determination of Asbestos in Bulk Building Materials" (EPA 600/R-93/116)

ACCREDITED: National Institute of Standards and Technology (NVLAP) # 200037

SAMPLE ID NUMBER	SAMPLE LOCATION AND DESCRIPTION	NON-FIBROUS MATERIALS	OTHER FIBROUS MATERIALS	ASBESTIFORM MINERALS
01	North Office (PS1A) Floor Carpet glue	Granular Minerals Organics	None Detected	None Detected
02	North Office (PS2A) Wall Texture/ paint	Granular Minerals Organics	None Detected	None Detected
03	North Office (PS2A) Wall Joint compound	Granular Minerals Organics	None Detected	None Detected
04	North Office (PS2A) Wall Sheetrock	Granular Minerals Gypsum	Cellulose 10%	None Detected
05	North Office (PS2A) Wall Texture/ paint	Granular Minerals Organics	None Detected	None Detected

t: Trace (>1% = greater than 1%, <1% = less than 1%)

Optical Microscopist

Mike Maladzhikyan, Laboratory Director

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REPORT # 155-5222 continued:

REFERENCE: C26-22 / Marcus J. Metcalf - Merced Community College District / Merced College - Plant Science Bldg. 3600 M Street, Merced, CA

SAMPLE ID NUMBER	SAMPLE LOCATION AND DESCRIPTION	NON-FIBROUS MATERIALS	OTHER FIBROUS MATERIALS	ASBESTIFORM MINERALS
06	North Office (PS2A) Wall Joint compound	Granular Minerals Organics	None Detected	None Detected
07	North Office (PS2A) Wall Sheetrock	Granular Minerals Gypsum	Cellulose 10%	None Detected
08	Custodial Room Wall Sheetrock	Granular Minerals Gypsum	Cellulose 10%	None Detected
09	Men's Restroom Wall Brown Sheetrock	Granular Minerals Gypsum	Cellulose 10%	None Detected
10	North Office (PS1A) Wall Wallpaper	Granular Minerals Organics	Cellulose 10% Synthetics 5%	None Detected
11	Women's Restroom Wall Ceramic tile Adhesive	Granular Minerals Organics	None Detected	None Detected
12	Men's Restroom Wall Wall tile grout	Granular Minerals Organics	Wollastonite <1%	None Detected
13	Women's Restroom Floor Ceramic tile grout	Granular Minerals Mortar	None Detected	None Detected
14	North Office (PS1A) Wall Base cove Adhesive	Granular Minerals Organics	None Detected	None Detected
15	Classroom #2 (PS1) Wall Base cove Adhesive	Granular Minerals Organics	None Detected	None Detected

t: Trace >1% = greater than 1% <1 = less than 1%

Optical Microscopist

Mike Maladzhikyan, Laboratory Director

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WESTERN ANALYTICAL LABORATORY, Inc.
12734 Branford St. Suite #19, Arleta, CA 91331 • Tel: (818) 899-0949 • Email: WesternAnalytical@gmail.com

REFERENCE: C26-22 / Marcus J. Metcalf - Merced Community College District / Merced College - Plant Science Bldg. 3600 M Street, Merced, CA

SAMPLE ID NUMBER	SAMPLE LOCATION AND DESCRIPTION	NON-FIBROUS MATERIALS	OTHER FIBROUS MATERIALS	ASBESTIFORM MINERALS
16	Classroom #2 (PS2) Ceiling 2'x 4' Ceiling panel	Granular Minerals Organics Perlite	Cellulose 30% Glass Wool 30%	None Detected
17	Men's Restroom Ceiling 2'x 4' Ceiling panel	Granular Minerals Organics Perlite	Glass Wool 60%	None Detected
18	Green House Exterior Wall Wall paneling	Granular Minerals Mortar	None Detected	Chrysotile 5%
19	Foundation Concrete	Granular Minerals Mortar	None Detected	None Detected
20	Roof Roof mastic	Granular Minerals Organics (tar)	Cellulose 80% Glass Wool 1%	None Detected
21	Roof Ducting Duct tape sealant	Granular Minerals Organics	None Detected	None Detected

t: Trace >1% = greater than 1% <1 = less than 1%

Optical Microscopist

Mike Maladzhikyan, Laboratory Director

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Reading No	Type	Units	Building	Room	Exterior	Side	Component	Substrate	Color	Results	Pbc
7	PAINT	mg / cm ^2	Plant Science		EXTERIOR	A	WALL	METAL	BEIGE	Negative	0.00
8	PAINT	mg / cm ^2	Plant Science		EXTERIOR	A	DOOR	METAL	BEIGE	Negative	0.00
9	PAINT	mg / cm ^2	Plant Science		EXTERIOR	A	DOOR FRAME	METAL	BEIGE	Negative	0.10
10	PAINT	mg / cm ^2	Plant Science		EXTERIOR	B	DOOR FRAME	METAL	BEIGE	Negative	0.20
11	PAINT	mg / cm ^2	Plant Science		EXTERIOR	B	DOOR	METAL	BEIGE	Negative	0.10
12	PAINT	mg / cm ^2	Plant Science		EXTERIOR	B	WALL	METAL	BEIGE	Negative	0.10
13	PAINT	mg / cm ^2	Plant Science		EXTERIOR	B	WALL	METAL	BEIGE	Negative	0.10
14	PAINT	mg / cm ^2	Plant Science		EXTERIOR	B	DOOR	METAL	BEIGE	Negative	0.10
15	PAINT	mg / cm ^2	Plant Science		EXTERIOR	B	DOOR FRAME	METAL	BEIGE	Negative	0.10
16	PAINT	mg / cm ^2	Plant Science		EXTERIOR	B	DOOR FRAME	METAL	BEIGE	Negative	0.20
17	PAINT	mg / cm ^2	Plant Science		EXTERIOR	B	DOOR	METAL	BEIGE	Negative	0.00
18	PAINT	mg / cm ^2	Plant Science		EXTERIOR	C	WALL	METAL	BEIGE	Negative	0.00
19	PAINT	mg / cm ^2	Plant Science		EXTERIOR	C	WALL	METAL	BEIGE	Negative	0.00
20	PAINT	mg / cm ^2	Plant Science		EXTERIOR	D	WALL	METAL	BEIGE	Negative	-0.10
21	PAINT	mg / cm ^2	Plant Science		EXTERIOR	D	DOOR FRAME	METAL	BEIGE	Negative	0.20
22	PAINT	mg / cm ^2	Plant Science		EXTERIOR	D	DOOR	METAL	GREEN	Negative	0.00
23	PAINT	mg / cm ^2	Plant Science		EXTERIOR	D	DOOR	METAL	GREEN	Negative	0.00
24	PAINT	mg / cm ^2	Plant Science		EXTERIOR	D	DOOR FRAME	METAL	BEIGE	Negative	0.20
25	PAINT	mg / cm ^2	Plant Science		EXTERIOR	D	WALL	METAL	BEIGE	Negative	0.10
26	PAINT	mg / cm ^2	Plant Science		Classroom	D	DOOR	METAL	BEIGE	Negative	0.00
27	PAINT	mg / cm ^2	Plant Science		Classroom	D	DOOR FRAME	METAL	BEIGE	Negative	0.10
28	PAINT	mg / cm ^2	Plant Science		Classroom	C	DOOR FRAME	METAL	BEIGE	Negative	0.10
29	PAINT	mg / cm ^2	Plant Science		Classroom	C	DOOR FRAME	METAL	BEIGE	Negative	0.10
30	PAINT	mg / cm ^2	Plant Science		Classroom	B	DOOR FRAME	METAL	BEIGE	Negative	0.20
31	PAINT	mg / cm ^2	Plant Science		EXTERIOR	B	EAVE	METAL	RED	Negative	0.30
32	PAINT	mg / cm ^2	Plant Science		EXTERIOR	B	EAVE	METAL	RED	Negative	0.40
33	PAINT	mg / cm ^2	Plant Science		EXTERIOR	D	EAVE	METAL	RED	Negative	0.30

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Report for:

Tommy Leon
Leon Environmental
4545 N. Brawley Ave., Suite 104
Fresno, CA 93722

Regarding: Project: C26-22; Merced College, Plant Science Bldg, Merced, CA
EML ID: 2855367

Approved by:

Laboratory Manager
Danny Li

Dates of Analysis:
Lead - Flame AA: 02-17-2022

Service SOPs: Lead - Flame AA (EM-BC-S-8443)
AIHA-LAP, LLC accredited service, Lab ID #178697

All samples were received in acceptable condition unless noted in the Report Comments portion in the body of the report. Due to the nature of the analyses performed, field blank correction of results is not applied. The results relate only to the samples as received and tested. Sample size, as it relates to Wipe samples only, is supplied by the client.

Eurofins EMLab P&K ("the Company") shall have no liability to the client or the client's customer with respect to decisions or recommendations made, actions taken or courses of conduct implemented by either the client or the client's customer as a result of or based upon the Test Results. In no event shall the Company be liable to the client with respect to the Test Results except for the Company's own willful misconduct or gross negligence nor shall the Company be liable for incidental or consequential damages or lost profits or revenues to the fullest extent such liability may be disclaimed by law, even if the Company has been advised of the possibility of such damages, lost profits or lost revenues. In no event shall the Company's liability with respect to the Test Results exceed the amount paid to the Company by the client therefor.

Eurofins EMLab P&K's LabServe® reporting system includes automated fail-safes to ensure that all AIHA-LAP, LLC quality requirements are met and notifications are added to reports when any quality steps remain pending.

Eurofins EMLab P&K
2841 Dow Avenue, Suite 300, Tustin, CA 92780
(866) 888-6653 Fax (623) 780-7695 www.emlab.com

Client: Leon Environmental
C/O: Tommy Leon
Re: C26-22; Merced College, Plant Science Bldg, Merced, CA

Date of Sampling: 02-16-2022
Date of Receipt: 02-17-2022
Date of Report: 02-17-2022

LEAD: FLAME ATOMIC ABSORPTION SPECTROMETRY

Location:	L01: Women's RR Floor/ Brown Ceramic Tile	L02: Women's RR Wall/White Ceramic Tile	L03: Men's RR Wall/Green Ceramic Tile
Comments (see below)	None	None	None
Lab ID-Version‡:	13684291-1	13684292-1	13684293-1
Analysis Date:	02/17/2022	02/17/2022	02/17/2022
Sample type	Bulk sample	Bulk sample	Bulk sample
Method*	NIOSH 7082 & EPA 7000B modified	NIOSH 7082 & EPA 7000B modified	NIOSH 7082 & EPA 7000B modified
† Method Reporting Limit	0.0040%	0.0039%	0.0039%
Sample size	0.2501 grams	0.2576 grams	0.2545 grams
§Total Lead Result	< 0.0040%	0.041%	0.017%
Summary	N/A	N/A	N/A

Comments:

Sample results have not been corrected for blank values.

Bulk samples are not covered under the AIHA-LAP, LLC service accreditation.

Wipe samples must meet ASTM E1792 criteria. Method Reporting Limits may not be valid for non-ASTM E1792 wipe samples.

*Sample preparation and analytical methods are based upon NIOSH 7082 and EPA 7000B.

¥ Guidelines for the HUD/EPA lead-based paint disclosure rule state that 0.5 % by weight or 1.0 mg/cm² is the definition of a lead-based paint.

† The Method Reporting Limit is the minimum concentration of Lead that the laboratory can confidently detect in the sample.

§ Total Lead Result has been rounded to two significant figures to reflect analytical precision.

‡ A "Version" indicated by -"x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".

CHAIN OF CUSTODY

www.EMLabPK.com

EMLab P&K
A TestAmerica Company

New Jersey: 3000 Lincoln Drive East, Suite A, Marlton, NJ 08003 * (866) 871-1984
Phoenix, AZ: 1501 West Knudsen Drive, Phoenix, AZ 85027 * (800) 651-4802
San Bruno, CA: 1150 Bayhill Drive, #100, San Bruno, CA 94066 * (866) 888-6653

Weather	Fog	Rain	Snow	Wind	Clear
Level: None	☐	☐	☐	☐	☑
Light	☐	☐	☐	☐	
Moderate	☐	☐	☐	☐	
Heavy	☐	☐	☐	☐	

002855367

CONTACT INFORMATION

Company:	Leon Environmental Services	Address:	4545 N. Brawley Ave, #104, Fresno, CA
Contact:	Tommy Leon	Special Instructions:	
Phone:	559-274-9200		

PROJECT INFORMATION

Project ID:	C26-22		
Project Description:	Merced College, Plant Science Bldg, Merced, CA		
Project Zip Code:		Sampling Date & Time:	2/16/2022
PO Number:		Sampled By:	TML

TURN AROUND TIME CODES (TAT)

- STD - Standard (DEFAULT)
- ND - Next Business Day
- SD - Same Business Day Rush
- WH - Weekend / Holiday

Rushes received after 2pm or on weekends, will be considered received the next business day. Please alert us in advance of weekend analysis needs.

REQUESTED SERVICES (Use Checkboxes below)

Non-Culturable: Spore Trap; Tape Swab Bulk
Culturable: BioCassette, Andersen, SAS, Swab, Wa Dust, Soil, Contact Plates

Sample ID	Description	Sample Type (Below)	TAT (Above)	Total Volume / Area (as applicable)	Notes (Time of day, Temp, RH, etc)	Requested Service
L01	Women's RR Floor / Brown Ceramic Tile	B	SD			☑ Lead (Pb) - Flame AA
L02	Women's RR Wall / White Ceramic Tile	B	SD			☑ Lead (Pb) - Flame AA
L03	Men's RR Wall / Green Ceramic Tile	B	SD			☑ Lead (Pb) - Flame AA

Services listed (checkbox columns): Fungi - Spore Trap Analysis; Spore Trap Analysis - Other particles; Direct Microscopic Exam (Qualitative); Quantitative Spore Count Direct Exam; 1-Media Surface Fungi (Genus ID + Asp. Spp.); 2-Media Surface Fungi (Genus ID + Asp. Spp.); 3-Media Surface Fungi (Genus ID + Asp. Spp.); Culturable Air Fungi (Genus ID + Asp. Spp.); Gram Stain & Counts (Culturable Air & Surface Bacteria); Legionella culture; Total Coliform, E. coli (Presence/Absence); Membrane Filtration (specify organism):; MPN Bacteria (specify organism):; QuantiTray - Sweage Screen; Asbestos Analysis - PCM Airborne Fiber Count (NIOSH 7400); Asbestos Analysis - PLM (EPA method 600/R-93-116); Lead (Pb) - Flame AA; PCR (specify test):

SAMPLE TYPE CODES

BC - BioCassette	ST - Spore Trap: Zefon, Allergenco, Burkard . . .	T - Tape	D - Dust
A1S - Anderson		SW - Swab	SO - Soil
SAS - Surface Air Sampler	P - Potable Water	B - Bulk	
CP - Contact Plate	NP - Non-Potable Water	O - Other	

RELINQUISHED BY	DATE & TIME	RECEIVED BY	DATE & TME
Tommy Leon	2-16-22	[signature]	2/17/22 10:20am

By submitting this Chain of Custody, you agree to be bound by the terms and conditions set forth at http://www.emlab.com/s/main/serviceterms.html

Project: AgTEC ***Darden Project # 2263***
Client: Merced College
Location: Merced, CA

APPENDIX "B": INTERIOR COLOR SCHEDULE

MATERIAL	MANUFACTURER	REF #	DESCRIPTION
POLISHED CONCRETE FINISHING			
Polished Concrete			
Color 1	Bomanite	-	Natural
Unless Otherwise Noted			
Color 2	Bomanite	-	Medium Grey
Occurs in Retail 101a only.			
Refer to Sheets A/A801 and A/A802.			
METAL PANELS			
MP-3, Corrugated Type 2	Western States Metal Roofing		Painted Rusted Roofing, Fresh Rust
Note: Finish above was used on adjacent AG IT Building. Finishes need to match. Refer to Sheet A/A601.			
MILLWORK			
Birch Horizontal Wood Planks			Stained to match to Wilsonart 7990-38 Mission Maple
Birch Wood Panel			Stained to match to Wilsonart 7990-38 Mission Maple
Birch Wood Shelf			Stained to match to Wilsonart 7990-38 Mission Maple
MODULAR CASEWORK			
Plastic Laminate			
Base Cabinet w/ Drawers	Wilsonart	7935K- 07	Shaker Cherry (PL-1)
Wall Hung Cabinet	Wilsonart	7935K- 07	Shaker Cherry (PL-1)
Base Cabinet w/ ADA Cover	Wilsonart	7935K- 07	Shaker Cherry (PL-1)
Solid Surfacing			
Countertop/Splash	Corian	-	Concrete
Unless Otherwise Noted			
Window Sill	Corian	-	Cameo White
Refer to Opening Schedule for Locations.			
Countertop @ Service Counter	Corian	-	White Jasmine
Custom Service Counter, Casework No. a 101a.			
Solid Surface	Corian	-	White Jasmine
Plastic Laminate	Wilsonart	7990-38	Mission Maple (PL-2)
Birch Horizontal Planks			Stained to match to Wilsonart 7990-38 Mission Maple (PL-2)
Steel Tube Steel			Painted Color 4, Dunn Edwards DEA002 Black.
Refer to Sheet X/A310 for Details.			
Custom Display Shelf, Casework No. c 101b.			
Steel Tube Steel			Painted Color 4, Dunn Edwards DEA002 Black.
Birch Wood Shelf			Stained to match to Wilsonart 7990-38 Mission Maple
Birch Wood Panel			Stained to match to Wilsonart 7990-38 Mission Maple
Burnt etched Logo			Digital File of Logo to be provided to Contractor.
Refer to Sheet X/A311 for Details.			

APPENDIX "B": INTERIOR COLOR SCHEDULE

MATERIAL	MANUFACTURER	REF #	DESCRIPTION
LAMINATE FACED WOOD DOORS			
Door and Frame	Wilsonart	7935K-07	Shaker Cherry
STOREFRONT			
Door and Frame			
Color 1	Kawneer	14	Clear Anodized
Unless Otherwise Noted			
Color 2	Kawneer	29	Black
To occur at opening 101a f, and 101a g only.			
TILE			
Ceramic, Interior Floor Tile			
CT-1	Dal-Tile	D200	Desert Gray Speckle, 2" x 2".
Grout to be Custom Building Products #09 Natural Gray.			
Refer to Sheet A/A801, A/A802 and Interior Finish Schedule for locations.			
Porcelain, Interior Floor Tile			
CT-2	Dal-Tile	IC13	Ironcraft, Charcoal Grey, 2" x 2"
Grout to be Custom Building Products #09 Natural Gray.			
Refer to Sheet A/A801, A/A802 and Interior Finish Schedule for locations.			
Ceramic, Interior Wall Tile			
CT-3	Dal-Tile	0190	Arctic White, 4" x 4"
CT-4	Dal-Tile	K189	Navy, 4" x 4"
Refer to E1/A/A803 for Tile Pattern.			
CT-5	Dal-Tile	0190	Arctic White, 3" x 6"
CT-6	Dal-Tile	0190	Arctic White, 4" x 12"
CT-7	Dal-Tile	1459	Color Wheel Retro, Galaxy
Grout to be Custom Building Products #381 Bright White			
Refer to Interior Finish Schedule and Interior Elevations for location and layout.			
Porcelain Interior Wall Tile			
CT-8	Dal-Tile	TP-49	Slimlite, Distressed Brass
Grout to be Custom Building Products #540 Truffle			
Refer to Interior Finish Schedule and Interior Elevations for location and layout.			
Jolly Edge Trim	Schluter Systems	-	Satin Anodized
Refer to Detail E11/X/A603.			
RESILIENT BASE AND ACCESSORIES			
Rubber Base/Transitions	Mannington	701	Black

APPENDIX "B": INTERIOR COLOR SCHEDULE

MATERIAL	MANUFACTURER	REF #	DESCRIPTION
RESILIENT TILE			
Luxury Vinyl Tile (RT-1)	Mohawk	829	Living Local, Sandy
Refer to Sheet A/A801, A/A802 and Interior Finish Schedule for locations.			
RESINOUS FLOORING			
Resinous Floor			
Type 1, RF-1	Stonehard	-	Steel Gray
Type 2, RF-2	Stonehard	-	Steel Gray
Refer to Sheet A/A801, A/A802 and Interior Finish Schedule for locations.			
WALL COVERINGS			
Fiberglass Reinforced Panels			
FRP Panel	Crane Composites	-	White
Stainless Steel Outside Corner	Crane Composites	OC-1108	Stainless Steel, No. 4 Brushed
Vinyl Covered Tackboard	Koroseal	LN21-28	Lino-Loom
Custom Graphic Wallcovering	MDC		Custom Graphic, Architect to provide file
Trim	Fry Reglet		Black
Refer to Interior Elevation on Sheet A/A601 and Detail J14/XA603.			
PAINT			
Gypsum Board			
Color 1	PPG		Match to Kelly Moore Arctic White KM4968
Unless otherwise noted.			
Color 2	PPG		Match to Kelly Moore Not my Fault KM5825
Color 3	PPG		Match to Kelly Moore Midnight Pearl KM4875
Color 4	PPG		Match to Dunn Edwards DEA002 Black.
Refer to Sheet A801,			
Coiling Door			
Color 2	PPG		Match to Kelly Moore Not my Fault KM5825
Millwork			
Birch Horizontal Wood Planks			Stained to match to Wilsonart 7990-38 Mission Maple
Birch Wood Panel			Stained to match to Wilsonart 7990-38 Mission Maple
Birch Wood Shelf			Stained to match to Wilsonart 7990-38 Mission Maple
Refer to Sheet X/A311 for Details.			
Metal Doors/Frames			
Color 2	PPG	-	ch to Kelly Moore Not my Fault KM5825
Unless Otherwise Noted			

APPENDIX "B": INTERIOR COLOR SCHEDULE

MATERIAL	MANUFACTURER	REF #	DESCRIPTION
Steel and Fabrications			
Color 2	PPG	-	ch to Kelly Moore Not my Fault KM5825
Unless Otherwise Noted			
Color 4			Dunn Edwards DEA002 Black.
@ Custom Service Counter and Custom Display Shelves in Retail 101a.			
Color 6	PPG	-	o Dunn Edwards Novelty Navy DE6335
@ Steel Structure in Retail 101a only. Paint Color to match Exterior Color MC-3.			
Metal Deck			
Color 1	PPG	-	ch to Kelly Moore Arctic White KM4968
Unless Otherwise Noted			
Acoustical Metal Deck			
Color 5	PPG		Match to Kelly Moore Sandpiper Cove KM5821
@ Retail 101a only. Paint Color to match Exterior Color MC-2.			
Mechanical			
Exposted Mecanical Items	PPG	-	Paint to match adjacent surface
Unless Otherwise Noted			
Linear Supply			
Color 7	PPG		Match to Dunn Edwards DE6144 Graham Cracker.
@ Retail 101a, North Wall.			
Color 4	PPG		Match to Dunn Edwards DEA002 Black.
@ Retail 101a, East Wall.			
Rough Carpentry			
Wall Panels	PPG		Match to Kelly Moore Arctic White KM4968
FRT Sheathing Flooring	PPG		Match to Kelly Moore Not my Fault KM5825
MISCELLANEOUS SPECIALTIES			
Dimensional Letters: Laser Cut Acrylic			
Color 1	Fast Signs	2767	Gemini, Midnight Blue
Color 2	Fast Signs	5687	Gemini, White
Refer to Interior Elevations for location			
Dimensional Letters: Fabricated Metal			
Color 1	Gemini	DE6335	Match to Dunn Edwards Novelty Navy
Refer to Detail E1/X/A515			

APPENDIX "B": INTERIOR COLOR SCHEDULE

MATERIAL	MANUFACTURER	REF #	DESCRIPTION
Dimensional Letters Flat Cut:	Gemini	-	Burshed Bronze
Contractor to coordinate installation of dimensional letter within CAST-IN-PLACE Concrete Slab.			
WALL AND CORNER GUARDS			
Corner Guards	Inpro	0238	Feather
Refer to Floor Plans and Interior Elevations for location			
High Impact Wall Covering			
Color 1	Inpro	0165	Point Blue
@ Nutrition 130a only. Refer to E10/A/A803 for location.			
Color 2	Inpro	0238	Feather
@ Vegtable Crop Processing 128.			
SHADES			
Fascia	Mechoshade	-	White
Shadeband	Mechoshade	1516	Eggshell
Refer to Opening Schedule for locations.			

GENERAL NOTES:

1. The intent of this schedule is to clarify and detail the color and patterns of finishes. All information regarding construction conditions, casework, framing and ceiling details, etc. shall be per Architectural plans, unless otherwise noted.
2. Interior Color Schedule to be used in conjunction with Architectural plans and Specifications.
3. Paint colors listed on Interior Color Schedule are for color reference only. Refer to Architectural Specifications and Finish Schedules for information regarding paint systems.
4. Change of paint color to occur on an inside corner, unless otherwise noted.
5. All gypsum board surfaces to be painted Color 1, unless otherwise noted.
7. All access doors and frames to be painted to match color of adjacent surface.
8. All miscellaneous exposed to view metal and mechanical equipment receiving a field finish to be painted to match color of adjacent surface.
9. All interior ladders and ladder assemblies to be painted Color 2.
10. All accent paint, changes in paint color and extent of paint and accent paint to be verified by Darden Architects at job site prior to commencement of work.
11. Samples and mock-up of each polished concrete color must be provided to, and approved by, Darden Architects prior to commencement of work.
12. All polished concrete to be Color 1, unless otherwise noted.
13. All finishes to extend inside accessible base cabinets.
14. All modular casework edge banding to match adjacent plastic laminate.
15. See Exterior Color Schedule for exterior door frame color.
16. All paints and stains are to be submitted in the form of brush outs to Darden Architects for approval prior to commencement of work.

Project: AgTEC ***Darden Project # 2263***
Client: Merced College
Location: Merced, CA

APPENDIX "C": EXTERIOR COLOR SCHEDULE

MATERIAL	MANUFACTURER	REF #	DESCRIPTION
CAST-IN-PLACE			
Concrete Color	-	-	Natural
CONCRETE MASONRY UNITS			
Veneer Block, Split Face			
BC-1	Basalite	-	Color 128 (Dixon Plant)
Refer to Architectural Elevations for locations of colors. Mortar to be selected by submittal.			
Block, Split Face			
BC-1	Basalite	-	Color 128 (Dixon Plant)
Refer to Architectural Elevations for locations of colors. Mortar to be selected by submittal.			
METAL PANELS			
Metal Panels			
MP-1, Standing Seam Panel	Sherwin Williams Coating	439ZZ088M	Medium Gray
MP-2, Inverted Box Rib Panel	Sherwin Williams Coating	433B496	Sandstone
MP-3, Corrugated, Type 2	Western States Metal Roofing	-	Fresh Rust
MP-4, Corrugated Perforated Pan	Western States Metal Roofing	-	Fresh Rust
MP-5, Corrugated, Type 1	Sherwin Williams Coating	433B496	Sandstone
Refer to Architectural Elevations for locations of colors.			
FIBER-CEMENT PANELS			
Cement Panels			
FC-1	Swiss Pearl	VI071	Vintago
Wall behind fiber cement to be painted DEA002 Black prior to install.			
Sheet metal 20 gauge galvanized sheet behind panels to be painted DEA002 Black			
STOREFRONT			
Door and Frame			
Color 1	Kawneer	14	Clear Anodized
Unless otherwise noted.			
Color 2	Kawneer	29	Black
To occur at opening 101a f, and 101a g only.			
CEMENT PLASTER			
Cement Plaster			
PC-1	PPG to match Behr	N320-4	Camping Tent
Unless otherwise noted.			
PC-2	PPG to match Kelly Moore	KM5821	Sandpiper Cove
Refer to Architectural Elevations for locations of colors.			
PAINT			
Steel and Fabrications			
Gutters/Downspouts:			Match to adjacent surface

APPENDIX "C": EXTERIOR COLOR SCHEDULE

Exposed Structural Steel:			
MC-1	PPG to match Behr	N320-4	Camping Tent
MC-2	PPG to match Kelly Moore	KM5821	Sandpiper Cove
MC-3	PPG to match Dunn Edwards	DE6335	Novelty Navy
Fixed Bollard:			
MC-2	PPG to match Kelly Moore	KM5821	Sandpiper Cove
Bench Beam:			
MC-3	PPG to match Dunn Edwards	DE6335	Novelty Navy
2" x 4" x 3/16" HSS Bench:			
MC-4	PPG	PPG16-23	Tampico Brown
Signage at Storefront:			
MC-3	PPG to match Dunn Edwards	DE6335	Novelty Navy
Refer to Detail E1/X/A515			
Aluminum Plate	Powdercoat to match	DE6335	Novelty Navy
Sheet Metal			
Parapet caps:	PPG		Match to adjacent surface
Material Transition	PPG to match Sherwin Williams Coating		439ZZ088M Medium Gray
To occur where Metal Panel MP-1 transitions to another material			
Coiling Door	PPG to match Kelly Moore	KM5821	Sandpiper Cove
Metal Doors / Frames			
Metal Doors/Frames:			
MC-1	PPG to match Behr	N320-4	Camping Tent
Unless otherwise noted			
MC-2	PPG to match Kelly Moore	KM5821	Sandpiper Cove
MC-4	PPG	PPG16-23	Tampico Brown
To occur at door 126a			
Metal Deck			
MC-2	PPG to match Kelly Moore	KM5821	Sandpiper Cove

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APPENDIX "C": EXTERIOR COLOR SCHEDULE

MISCELLANEOUS SPECIALITIES

Dimensional Letters

Refer to Detail E1/X/A515

Color 2	Gemini	4310	Dove Grey
Color 3	Gemini	5687	White

Refer to Architectural Elevations for locations of colors.

GENERAL NOTES:

1. Paint colors listed on Exterior Color Schedule are for color reference only. Refer to Architectural Specifications and Finish Schedules for type.
2. Change of color is to occur at control joints or an inside corner, unless otherwise noted.
3. Cement plaster accessories shall match primary color of adjacent material, unless otherwise noted. Cement plaster vents to remain unfinished.
4. Mechanical grille/louvers with factory baked enamel finish shall match primary color of adjacent hollow metal door frame. Louvers located in doors shall match door color.
5. All miscellaneous visual architectural sheet metal and steel fabrications including, but not limited to, mechanical/ plumbing/ electrical equipment shall match color of adjacent material, unless otherwise noted.
6. Soffits shall match color of outer face wall, unless otherwise noted.
7. Parapet caps shall match color of adjacent cement plaster.

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