

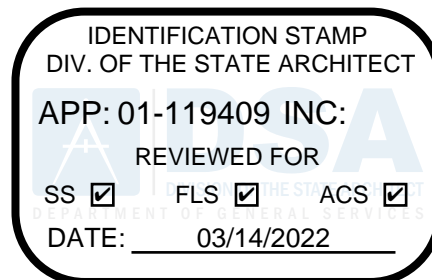
(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
N&T 22003	Oakland, California

MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX (MLH) MANUAL

PROJECT/CONTRACT NUMBER: 2463

**PERALTA
COMMUNITY COLLEGE DISTRICT**

December 3, 2021



(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
N&T 22003	Oakland, California

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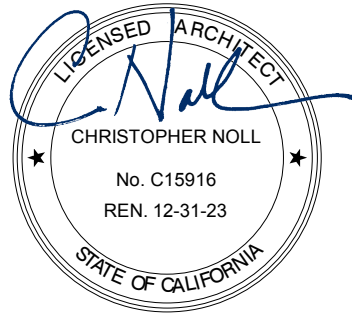
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SECTION 00 01 07 - SEALS PAGE

DESIGN PROFESSIONALS OF RECORD

1.01 ARCHITECT

- A. Company: Noll & Tam Architects
- B. Name: Chris Noll
- C. License No.: C15916
- D. Expires: 12/31/2023
- E. Responsible for Divisions 01-33 Sections except where indicated as prepared by other design professionals of record.



1.02 CIVIL ENGINEER

- A. Company: Sherwood Design Engineers
- B. Name: Jimmy A. Galvez
- C. License No.: C-75568
- D. Expires: June 30, 2022
- E. Responsible for portions of Division 2 and Divisions 31-33.



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1.03 STRUCTURAL ENGINEER

- A. Company: IDA Structural Engineers, Inc.
- B. Name: Stephen R. DeJesse
- C. License No.: S03527
- D. Expires: 03/31/2023
- E. Responsible for portions of Division 2 and Divisions



1.04 FIRE PROTECTION

- A. Company: HYT Corporation
- B. Name: Bret B. Tresidder
- C. License No.: Fire Protection Engineer #01165
- D. Expires: 09-30-2022
- E. Responsible for Division 21.



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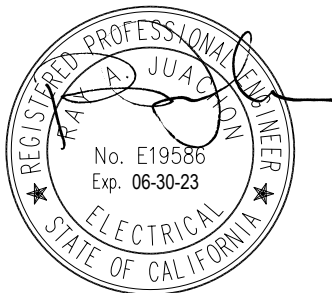
1.05 PLUMBING AND MECHANICAL ENGINEER

- A. Company: Blue Forest Engineering
- B. Name: Tyler Bradshaw
- C. License No.: M33496
- D. Expires: 6.30.2022
- E. Responsible for Divisions 22 and 23.



1.06 ELECTRICAL, COMMUNICATIONS AND SECURITY ENGINEER

- A. Company: RIJA
- B. Name: Ray A. Juachon
- C. License No.: E19586
- D. Expires: 6.30.2023
- E. Responsible for Divisions 26, 27 and 28.



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1.07 LANDSCAPE ARCHITECT

- A. Company: BASE Landscape Architecture, Inc.
- B. Name: Šárka Volejníková
- C. License No.: 5391
- D. Expires: 12/31/2023
- E. Responsible for portions of Division 2, 12, and Division 32.



END OF SECTION

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DOCUMENT 00 01 15

LIST OF DRAWINGS AND TABLES

DRAWINGS

Refer to Sheet G0.01 - Sheet Index dated March 3, 2022.

TABLES

NA.

END OF DOCUMENT

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DOCUMENT 00 11 16

NOTICE TO BIDDERS

1. Notice is hereby given that the governing board ("Board") of the Peralta Community College District ("District") will receive, by electronic submission, bids for the following project, **Bid No. _____, Bid Package _____** ("Project" or "Contract"):

2. The Project consists of:

This project consists of abatement and demolition of existing buildings and site improvements, construction of new classrooms, greenhouses and support spaces to house the Merritt College Landscape Horticulture Program, with associated site improvements. All buildings are single story. Occupancy classifications include A-3, B and U. Construction type is V-B, fully sprinkled. Automatic sprinkler system per NFPA 13, automatic fire alarm system per NFPA 72. Seismic zone E.

The work to be performed under this contract includes the furnishing of all labor, materials, equipment, transportation, services, permits, temporary controls and construction facilities, and all general conditions, seismic requirements, general requirements and incidentals required to complete the work on the project in its entirety as described in the contract documents.

3. To bid on this Project, the Bidder is required to possess one or more of the following State of California contractor license(s):

B – General Contracting

The Bidder's license(s) must remain active and in good standing throughout the term of the Contract.

4. To bid on this Project, the Bidder is required to be registered as a public works contractor with the Department of Industrial Relations pursuant to the Labor Code.
5. Contract Documents will be available on or after _____, 20____, for review at the District Vendor Registry website, and may be downloaded from the District's website, <https://vrapp.vendorregistry.com/Bids/View/BidsList?BuyerId=4d041f6c-7568-4c8a-8878-c82684292a3c>, using the **["Facilities Project and Information"]** link. In addition, Contract Documents are available for bidders' review at the following builders' exchanges:

- A. Builder's Exchange of _____ County (____) _____ - _____
- B. A list of these builders' exchanges is available at the District's Facilities Office.

6. **The District will only receive bids submitted electronically.** Bids will be received **until ____ a.m./p.m., _____, 20____**, only at the following email address [INSERT], after which time the bids will be opened and publicly read aloud via video conference. A link to the video conference will be provided by Addendum. Any bid that is submitted after this time shall be nonresponsive and returned to the bidder.
Each bidder is solely responsible for timely submission of its bid; the District

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is not responsible for any technological issues in a bidder's ability to timely submit its bid or portion thereof. Any claim by a bidder of error in its bid must be made in compliance with section 5100 et seq. of the Public Contract Code. Prior to publicly reading aloud bids at the video conference, the District reserves the right to verify the genuineness of any bid security.

7. Pursuant to Public Contract Code section 20111.5, only prequalified bidders will be eligible to submit a bid for this Project. Any bid submitted by a bidder who is not prequalified shall be non-responsive and returned by email to the bidder.
8. All bids shall be on the form provided by the District. Each bid must conform and be responsive to all pertinent Contract Documents, including, but not limited to, the Instructions to Bidders.
9. A bid bond by an admitted surety insurer on the form provided by the District, or a cashier's check or a certified check, drawn to the order of the Peralta Community College District, in the amount of ten percent (10%) of the total bid price, shall accompany the Bid Form and Proposal, as a guarantee that the Bidder will, within seven (7) calendar days after the date of the Notice of Award, enter into a contract with the District for the performance of the services as stipulated in the bid.
10. A mandatory pre-bid conference and site visit will be held on 20____, at ____m. at _____, California. All participants are required to sign in front of the _____ Building, _____, California. The site visit is expected to take approximately _____. Failure to attend or tardiness will render bid ineligible.
11. The successful Bidder shall be required to furnish a 100% Performance Bond and a 100% Payment Bond if it is awarded the contract for the Work.
12. The successful Bidder may substitute securities for any monies withheld by the District to ensure performance under the Contract, in accordance with the provisions of section 22300 of the Public Contract Code.
13. The Contractor and all Subcontractors under the Contractor shall pay all workers on all work performed pursuant to this Contract not less than the general prevailing rate of per diem wages and the general prevailing rate for holiday and overtime work as determined by the Director of the Department of Industrial Relations, State of California, for the type of work performed and the locality in which the work is to be performed within the boundaries of the District, pursuant to section 1770 et seq. of the California Labor Code. Prevailing wage rates are also available from the District or on the Internet at: <<http://www.dir.ca.gov>>.
14. This Project is subject to labor compliance monitoring and enforcement by the Department of Industrial Relations pursuant to Labor Code section 1771.4 and subject to the requirements of Title 8 of the California Code of Regulations. The successful Bidder shall comply with all requirements of Division 2, Part 7, Chapter 1, Articles 1-5 of the Labor Code.
15. The District has entered into a Project Labor Agreement that is applicable to this Project. A copy of the Project Labor Agreement is available for review at the District Facilities Office and may be downloaded from the District's website,

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<https://build.peralta.edu/construction-project-labor-agreement>. The successful bidder and all subcontractors will be required to agree to be bound by the Project Labor Agreement.

16. The Contractor and all Subcontractors under the Contractor shall comply with applicable federal, State, and local requirements relating to COVID-19 or other public health emergency/epidemic/pandemic including, if required, preparing, posting, and implementing a Social Distancing Protocol.
17. The District shall award the Contract, if it awards it at all, to the lowest responsive responsible bidder based on:
 - A. The base bid amount plus the following alternates:
 1. Additive Alternate 1: NOT USED
 2. Additive Alternate 2: ADDITIONAL GREENHOUSE EQUIPMENT
 3. Additive Alternate 3: PAVING TYPE
 4. Additive Alternate 4: GARDEN WATER FOUNTAINS
18. The Board reserves the right to reject any and all bids and/or waive any irregularity in any bid received. If the District awards the Contract, the security of unsuccessful bidder(s) shall be returned within sixty (60) days from the time the award is made. Unless otherwise required by law, no bidder may withdraw its bid for ninety (90) days after the date of the bid opening.

END OF DOCUMENT

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SECTION 00 21 13 – INSTRUCTIONS TO BIDDERS

Bidders shall follow the instructions in this document, and shall submit all documents, forms, and information required for consideration of a Bid.

Peralta Community College District ("District") will evaluate information submitted by the apparent low Bidder and, if incomplete or unsatisfactory to District, Bidder's bid may be rejected at the sole discretion of District.

1. Bids are requested for a general construction contract, or work described in general, for the following project ("Project" or "Contract"):

Merritt College New Landscape Horticulture Complex (MLH)

2. Bidder and its subcontractors must possess the appropriate State of California contractors' license and must maintain the license throughout the duration of the project. Bidders must also be registered as a public works contractor with the Department of Industrial Relations pursuant to the Labor Code. Bids submitted by a contractor who is not properly licensed or registered shall be deemed nonresponsive and will not be considered.
3. The District has prequalified bidders pursuant to Public Contract Code section 20651.5. Only prequalified bidders will be eligible to submit a bid for this Project. Any bid submitted by a bidder who is not prequalified shall be deemed nonresponsive and will not be considered.
4. District will receive bids submitted electronically from bidders as stipulated in the Notice to Bidders.
 - a. Email subject line must include the name of the Bidder, name of the Project, the Project Number and/or bid number, and time of bid opening.
 - b. Bids must be electronically submitted to the following email address [INSERT], by date and time shown in the Notice to Bidders.
 - c. Each bidder is solely responsible for timely submission of its bid; the District is not responsible for any technological issues affecting a bidder's ability to timely submit its bid or portion thereof.
5. Bidders are advised that on the date that bids are opened, the District Offices will **not** be open to bidders or their representatives.
6. Bids will be opened and publicly read aloud via video conference. A link to the video conference will be provided by Addendum. Prior to publicly reading aloud bids at the video conference, the District reserves the right to verify the genuineness of any bid security.
7. Bidders must submit Bids on the documents titled Bid Form and Proposal, and must submit all other required District forms. Bids not submitted on the District's required forms shall be deemed nonresponsive and shall not be considered. Additional sheets required to fully respond to requested information are permissible.
8. Bidders shall not modify the Bid Form and Proposal or qualify their bids. Bidders shall not submit to the District a re-formatted, re-typed, altered, modified, or otherwise recreated version of the Bid Form and Proposal or other District-provided document.

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9. Bids shall be clearly written and without erasure or deletions. District reserves the right to reject any bid containing erasures, deletions, or illegible contents.
10. Bidders must supply all information required by each Bid Document. Bids must be full and complete. District reserves the right in its sole discretion to reject any Bid as non-responsive as a result of any error or omission in the Bid. Bidders must complete and submit all of the following documents with the Bid Form and Proposal:
 - a. Photocopy of Bid Bond on the District's form, or other security.
 - b. Designated Subcontractors List.
 - c. Site Visit Certification, if a site visit was required.
 - d. Non-Collusion Declaration.
 - e. Iran Contracting Act Certification, if contract value is \$1,000,000 or more.
 - f. SLBE/SELBE Self Certification Affidavit.
11. Bidders must submit with their bids a legible photocopy of (i) a cashier's check or (ii) a certified check payable to District, or (iii) a bid bond by an admitted surety insurer of not less than ten percent (10%) of amount of Base Bid, plus all additive alternates ("Bid Bond"). If Bidder chooses to provide a Bid Bond as security, Bidder must use the required form of corporate surety provided by District. The Surety on Bidder's Bid Bond must be an insurer admitted in the State of California and authorized to issue surety bonds in the State of California. Bidder must deposit the original of the bid bond, cashier's check, or certified check in the mail on the same day as the bid opening. Bids submitted without necessary bid security will be deemed non-responsive and will not be considered.
12. If Bidder to whom the Contract is awarded fails or neglects to enter into the Contract and submit required bonds, insurance certificates, and all other required documents, within **SEVEN (7)** calendar days after the date of the Notice of Award, District may deposit Bid Bond, cashier's check, or certified check for collection, and proceeds thereof may be retained by District as liquidated damages for failure of Bidder to enter into Contract, in the sole discretion of District. It is agreed that calculation of damages District may suffer as a result of Bidder's failure to enter into the Contract would be extremely difficult and impractical to determine and that the amount of the Bidder's required bid security shall be the agreed and conclusively presumed amount of damages.
13. Bidders must submit with the Bid the Designated Subcontractors List for those subcontractors who will perform any portion of Work, including labor, rendering of service, or specially fabricating and installing a portion of the Work or improvement according to detailed drawings contained in the plans and specifications, in excess of one half of one percent (0.5%) of total Bid. Failure to submit this list when required by law shall result in bid being deemed nonresponsive and the bid will not be considered.
14. All of the listed subcontractors are required to be registered as a public works contractor with the Department of Industrial Relations pursuant to the Labor Code.
 - a. An inadvertent error in listing the California contractor license number on the Designated Subcontractors List shall not be grounds for filing a bid protest or grounds for considering the bid nonresponsive if the correct contractor's license number is submitted to the

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District within 24 hours after the bid opening and the corrected number corresponds with the submitted name and location for that subcontractor.

- b. An inadvertent error listing an unregistered subcontractor shall not be grounds for filing a bid protest or grounds for considering the bid nonresponsive provided that any of the following apply:
 - (1) The subcontractor is registered prior to the bid opening.
 - (2) The subcontractor is registered and has paid the penalty registration fee within 24 hours after the bid opening.
 - (3) The subcontractor is replaced by another registered subcontractor pursuant to Public Contract Code section 4107.
15. If a mandatory pre-bid conference and site visit ("Site Visit") is required as referenced in the Notice to Bidders, then Bidders must submit the Site-Visit Certification with their Bid. District will transmit to all prospective Bidders of record such Addenda as District in its discretion considers necessary in response to questions arising at the Site Visit. Oral statements shall not be relied upon and will not be binding or legally effective. Addenda issued by the District as a result of the Site Visit, if any, shall constitute the sole and exclusive record and statement of the results of the Site Visit.
16. Bidders shall submit the Non-Collusion Declaration with their Bids. Bids submitted without the Non-Collusion Declaration shall be deemed non-responsive and will not be considered.
17. The Contractor and all Subcontractors under the Contractor shall pay all workers on all work performed pursuant to the Contract not less than the general prevailing rate of per diem wages and the general prevailing rate for holiday and overtime work as determined by the Director of the Department of Industrial Relations, State of California, for the type of work performed and the locality in which the work is to be performed within the boundaries of the District, pursuant to sections 1770 et seq. of the California Labor Code. Copies of the general prevailing rates of per diem wages for each craft, classification, or type of worker needed to execute the Contract, as determined by Director of the Department of Industrial Relations, are available upon request at the District's principal office. Prevailing wage rates are also available on the internet at <http://www.dir.ca.gov>.
18. The District has entered into a Project Labor Agreement that is applicable to this Project. A copy of the Project Labor Agreement is available for review at the District Facilities Office and may be downloaded from the District's website, <https://static1.squarespace.com/static/5e6810f584453b295c7e79df/t/5e7d0d4eae9a1d4d1d8041dd/1585253726163/PLA-Agreement.pdf>. The successful bidder and all subcontractors will be required to agree to be bound by the Project Labor Agreement.
19. Submission of Bid signifies careful examination of Contract Documents and complete understanding of the nature, extent, and location of Work to be performed. Bidders must complete the tasks listed below as a condition to bidding, and submission of a Bid shall constitute the Bidder's express representation to District that Bidder has fully completed the following:
 - a. Bidder has visited the Site, if required, and has examined thoroughly and understood the nature and extent of the Contract Documents, Work, Site, locality, actual conditions, as-built conditions, and all local conditions and federal, state and local laws, and regulations that in any manner may affect cost, progress, performance, or furnishing of Work or that relate to any aspect of the means, methods, techniques, sequences, or procedures of

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construction to be employed by Bidder and safety precautions and programs incident thereto;

- b. Bidder has conducted or obtained and has understood all examinations, investigations, explorations, tests, reports, and studies that pertain to the subsurface conditions, as-built conditions, underground facilities, and all other physical conditions at or contiguous to the Site or otherwise that may affect the cost, progress, performance, or furnishing of Work, as Bidder considers necessary for the performance or furnishing of Work at the Contract Sum, within the Contract Time, and in accordance with the other terms and conditions of Contract Documents, including specifically the provisions of the General Conditions; and no additional examinations, investigations, explorations, tests, reports, studies, or similar information or data are or will be required by Bidder for such purposes;
- c. Bidder has correlated its knowledge and the results of all such observations, examinations, investigations, explorations, tests, reports, and studies with the terms and conditions of the Contract Documents;
- d. Bidder has given the District prompt written notice of all conflicts, errors, ambiguities, or discrepancies that it has discovered in or among the Contract Documents and the actual conditions, and the written resolution(s) thereof by the District, is/are acceptable to Bidder;
- e. Bidder has made a complete disclosure in writing to the District of all facts bearing upon any possible interest, direct or indirect, that Bidder believes any representative of the District or other officer or employee of the District presently has or will have in this Contract or in the performance thereof or in any portion of the profits thereof;
- f. Bidder must, prior to bidding, perform the work, investigations, research, and analysis required by this document and that Bidder represented in its Bid Form and Proposal and the Agreement that it performed prior to bidding. Contractor under this Contract is charged with all information and knowledge that a reasonable bidder would ascertain from having performed this required work, investigation, research, and analysis. Bid prices must include entire cost of all work "incidental" to completion of the Work.
- g. Conditions Shown on the Contract Documents: Information as to underground conditions, as-built conditions, or other conditions or obstructions, indicated in the Contract Documents, e.g., on Drawings or in Specifications, has been obtained with reasonable care, and has been recorded in good faith. However, District only warrants, and Bidder may only rely, on the accuracy of limited types of information.
 - (1) As to above-ground conditions or as-built conditions shown or indicated in the Contract Documents, there is no warranty, express or implied, or any representation express or implied, that such information is correctly shown or indicated. This information is verifiable by independent investigation and Bidder is required to make such verification as a condition to bidding. In submitting its Bid, Bidder shall rely on the results of its own independent investigation. In submitting its Bid, Bidder shall not rely on District-supplied information regarding above-ground conditions or as-built conditions.
 - (2) As to any subsurface condition shown or indicated in the Contract Documents, Bidder may rely only upon the general accuracy of actual reported depths, actual reported character of materials, actual reported soil types, actual reported water conditions, or actual obstructions shown or indicated. District is not responsible for the completeness of such information for bidding or construction; nor is

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District responsible in any way for any conclusions or opinions that the Bidder has drawn from such information; nor is the District responsible for subsurface conditions that are not specifically shown (for example, District is not responsible for soil conditions in areas contiguous to areas where a subsurface condition is shown).

- h. Conditions Shown in Reports and Drawings Supplied for Informational Purposes: Reference is made to the document entitled Geotechnical Data, and the document entitled Existing Conditions, for identification of:
- (1) Subsurface Conditions: Those reports of explorations and tests of subsurface conditions at or contiguous to the Site that have been utilized by Architect in preparing the Contract Documents; and
 - (2) Physical Conditions: Those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that has been utilized by Architect in preparing the Contract Documents.
 - (3) These reports and drawings are **not** Contract Documents and, except for any "technical" data regarding subsurface conditions specifically identified in Geotechnical Data and Existing Conditions, and underground facilities data, Bidder may not in any manner rely on the information in these reports and drawings. Subject to the foregoing, Bidder must make its own independent investigation of all conditions affecting the Work and must not rely on information provided by District.
20. Bids shall be based on products and systems specified in Contract Documents or listed by name in Addenda. Whenever in the Specifications any materials, process, or article is indicated or specified by grade, patent, or proprietary name, or by name of manufacturer, that Specification shall be deemed to be followed by the words "or equal." Bidder may, unless otherwise stated, offer any material, process, or article that shall be substantially equal or better in every respect to that so indicated or specified. The District is not responsible and/or liable in any way for a Contractor's damages and/or claims related, in any way, to that Contractor's basing its bid on any requested substitution that the District has not approved in advance and in writing. Contractors and materials suppliers who submit requests for substitutions prior to the award of the Contract must do so in writing and in compliance with Public Contract Code section 3400. All requests must comply with the following:
- a. District must receive any notice of request for substitution of a specified item a minimum of **TEN (10)** calendar days prior to bid opening. The Successful Bidder will not be allowed to substitute specified items unless properly noticed.
 - b. Within 35 days after the date of the Notice of Award, the Successful Bidder shall submit data substantiating the request(s) for all substitution(s) containing sufficient information to assess acceptability of product or system and impact on Project, including, without limitation, the requirements specified in the Special Conditions and the Specifications. Insufficient information shall be grounds for rejection of substitution.
 - c. Approved substitutions, if any, shall be listed in Addenda. District reserves the right not to act upon submittals of substitutions until after bid opening.
 - d. Substitutions may be requested after Contract has been awarded only if indicated in and in accordance with requirements specified in the Special Conditions and the Specifications.

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21. Bidders may examine any available “as-built” drawings of previous work by giving District reasonable advance notice. District will not be responsible for accuracy of “as-built” drawings. The document entitled Existing Conditions applies to all supplied “as-built” drawings.
22. All questions about the meaning or intent of the Contract Documents are to be directed via email to the District to _____. Interpretations or clarifications considered necessary by the District in response to such questions will be issued in writing by Addenda and delivered electronically to all parties recorded by the District as having received the Contract Documents or posted on the District’s website at _____. Questions received less than **SEVEN (7)** calendar days prior to the date for opening Bids may not be answered. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.
23. Addenda may also be issued to modify other parts of the Contract Documents as deemed advisable by the District.
24. All Addenda must be signed by the Project Architect and approved by the Division of the State Architect (CAC, Section 4-338 (b)).
25. Each Bidder must acknowledge each Addendum in its Bid Form and Proposal by number or its Bid shall be considered non-responsive. Each Addendum shall be part of the Contract Documents. A complete listing of Addenda may be secured from the District.
26. This Contract may include alternates. Alternates are defined as alternate products, materials, equipment, systems, methods, or major elements of the construction that may, at the District’s option and under terms established in the Contract and pursuant to section 20103.8 of the Public Contract Code, be selected for the Work.
27. The District shall award the Contract, if it awards it at all, to the lowest responsive responsible bidder based on the criteria as indicated in the Notice to Bidders. In the event two or more responsible bidders submit identical bids, the District shall select the Bidder to whom to award the Contract by lot.
28. Discrepancies between written words and figures, or words and numeral, will be resolved in favor of figures or numerals.
29. Bidders in contention for contract awards shall be required to attend a Post Bid interview, which will be set within three (3) calendar days following bid opening. A duly authorized representative of the apparent low bidder is required to attend the Post Bid Interview, in person. The apparent low bidder’s authorized representative(s) must have (1) knowledge of how the bid submitted was prepared, (2) the person responsible for supervising performance of the Work, and (3) the authority to bind the apparent low bidder. Failure to attend the Post Bid Interview as scheduled will be considered just cause for the District to reject the Bid as nonresponsive. .
30. Any bid protest by any Bidder regarding any other bid must be submitted in writing to the District, before 5:00 p.m. of the **THIRD (3rd)** business day following bid opening.
 - a. Only a Bidder who has actually submitted a bid, and who could be awarded the Contract if the bid protest is upheld, is eligible to submit a bid protest. Subcontractors are not eligible to submit bid protests. A Bidder may not rely on the bid protest submitted by another Bidder.

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- b. A bid protest must contain a complete statement of any and all bases for the protest and all supporting documentation. Materials submitted after the bid protest deadline will not be considered.
 - c. The protest must refer to the specific portions of all documents that form the basis for the protest.
 - (1) Without limitation to any other basis for protest, an inadvertent error in listing the California contractor's license number on the Designated Subcontractors List shall not be grounds for filing a bid protest or grounds for considering the bid nonresponsive if the correct contractor's license number is submitted to the District within 24 hours after the bid opening and the corrected number corresponds with the submitted name and location for that subcontractor.
 - (2) Without limitation to any other basis for protest, an inadvertent error listing an unregistered subcontractor shall not be grounds for filing a bid protest or grounds for considering the bid nonresponsive provided that any of the following apply:
 - (i) The subcontractor is registered prior to the bid opening.
 - (ii) The subcontractor is registered and has paid the penalty registration fee within 24 hours after the bid opening.
 - (iii) The subcontractor is replaced by another registered subcontractor pursuant to Public Contract Code section 4107.
 - d. The protest must include the name, address and telephone number of the person representing the protesting party.
 - e. The party filing the protest must concurrently transmit a copy of the protest and any attached documentation to all other parties with a direct financial interest that may be adversely affected by the outcome of the protest. Such parties shall include all other bidders or proposers who appear to have a reasonable prospect of receiving an award depending upon the outcome of the protest.
 - f. The procedure and time limits set forth in this paragraph are mandatory and are each bidder's sole and exclusive remedy in the event of bid protest. Failure to comply with these procedures shall constitute a waiver of any right to further pursue the bid protest, including filing a Government Code Claim or legal proceedings.
31. The Bidder to whom Contract is awarded shall execute and submit the following documents by 5:00 p.m. of the **SEVENTH (7th)** calendar day following the date of the Notice of Award. Failure to properly and timely submit these documents entitles District to reject the bid as nonresponsive.
- a. Agreement: To be executed by successful Bidder. Submit four (4) copies, each bearing an original signature.
 - b. Escrow of Bid Documentation: This must include all required documentation. See the document titled Escrow Bid Documentation for more information.
 - c. Performance Bond (100%): On the form provided in the Contract Documents and fully executed as indicated on the form.

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- d. Payment Bond (Contractor's Labor and Material Bond) (100%): On the form provided in the Contract Documents and fully executed as indicated on the form.
 - e. Insurance Certificates and Endorsements as required.
 - f. Workers' Compensation Certification.
 - g. Prevailing Wage and Related Labor Requirements Certification.
 - h. Drug-Free Workplace Certification.
 - i. Tobacco-Free Environment Certification.
 - j. Hazardous Materials Certification.
 - k. Lead-Based Materials Certification.
 - l. Imported Materials Certification.
 - m. Sex Offender Registration Act Certification.
 - n. Buy American Certification.
 - o. Small Local Business Enterprise and Small Emerging Local Business Enterprise Program.
 - p. Registered Subcontractors List: Must include Department of Industrial Relations (DIR) registration number of each subcontractor for all tiers. Per Article 10 of the General Conditions, the complete submittal of Registered Subcontractors List is required within 10 days after the Notice to Proceed is issued.
32. Time for Completion: District may issue a Notice to Proceed within **NINETY (90)** days from the date of the Notice of Award. Once Contractor has received the Notice to Proceed, Contractor shall complete the Work within the period of time indicated in the Contract Documents.
- a. In the event that the District desires to postpone issuing the Notice to Proceed beyond this 90-day period, it is expressly understood that with reasonable notice to the Contractor, the District may postpone issuing the Notice to Proceed.
 - b. It is further expressly understood by Contractor that Contractor shall not be entitled to any claim of additional compensation as a result of the postponement of the issuance of the Notice to Proceed beyond a 90-day period. If the Contractor believes that a postponement of issuance of the Notice to Proceed will cause a hardship to the Contractor, the Contractor may terminate the Contract. Contractor's termination due to a postponement beyond this 90-day period shall be by written notice to District within **TEN (10)** calendar days after receipt by Contractor of District's notice of postponement.
 - c. It is further understood by the Contractor that in the event that Contractor terminates the Contract as a result of postponement by the District, the District shall only be obligated to pay Contractor for the Work that Contractor had performed at the time of notification of postponement and which the District had in writing authorized Contractor to perform prior to issuing a Notice to Proceed.

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- d. Should the Contractor terminate the Contract as a result of a notice of postponement, District shall have the authority to award the Contract to the next lowest responsive responsible bidder.
33. District reserves the right to reject any or all bids, including without limitation the right to reject any or all nonconforming, non-responsive, unbalanced, or conditional bids, to re-bid, and to reject the bid of any bidder if District believes that it would not be in the best interest of the District to make an award to that bidder, whether because the bid is not responsive or the bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by District. District also reserves the right to waive any inconsequential deviations or irregularities in any bid. For purposes of this paragraph, an "unbalanced bid" is one having nominal prices for some work items and/or enhanced prices for other work items.
34. It is the policy of the District that no qualified person shall be excluded from participating in, be denied the benefits of, or otherwise be subjected to discrimination in any consideration leading to the award of contract, based on race, color, gender, sexual orientation, political affiliation, age, ancestry, religion, marital status, national origin, medical condition or disability. The Successful Bidder and its subcontractors shall comply with applicable federal and state laws, including, but not limited to the California Fair Employment and Housing Act, beginning with Government Code section 12900, and Labor Code section 1735.
35. Prior to the award of Contract, District reserves the right to consider the responsibility of the Bidder. District may conduct investigations as District deems necessary to assist in the evaluation of any bid and to establish the responsibility, including, without limitation, qualifications and financial ability of Bidders, proposed subcontractors, suppliers, and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents to District's satisfaction within the prescribed time.

END OF SECTION

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SECTION - 00 21 13.1

BIDDER INFORMATION AND FORMS

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– SEPARATE PREQUALIFICATION PROCESS RECOMMENDED]**

END OF SECTION

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SECTION 00 31 19 – EXISTING CONDITIONS

1. Summary

This document describes existing conditions at or near the Project, and use of information available regarding existing conditions. This document is **not** part of the Contract Documents. See General Conditions for definition(s) of terms used herein.

2. Reports and Information on Existing Conditions

- a. Documents providing a general description of the Site and conditions of the Work may have been collected by Peralta Community College District ("District"), its consultants, contractors, and tenants. These documents may, but are not required to, include previous contracts, contract specifications, tenant improvement contracts, as-built drawings, utility drawings, and information regarding underground facilities.
- b. Information regarding existing conditions may be inspected at the District offices or the Construction Manager's offices, if any, and copies may be obtained at cost of reproduction and handling upon Bidder's agreement to pay for such copies. These reports, documents, and other information are **not** part of the Contract Documents. These reports, documents, and other information do **not** excuse Contractor from fulfilling Contractor's obligation to independently investigate any or all existing conditions or from using reasonable prudent measures to avoid damaging existing improvements.
- c. Information regarding existing conditions may also be included in the Project Manual, but shall **not** be considered part of the Contract Documents.
- d. Prior to commencing this Work, Contractor and the District's representative shall survey the Site to document the condition of the Site. Contractor will record the survey in digital videotape format and provide an electronic copy to the District within fourteen (14) days of the survey.
- e. Contractor may also document any pre-existing conditions in writing, provided that both the Contractor and the District's representative agree on said conditions and sign a memorandum documenting the same.

3. Use of Information

- a. Information regarding existing conditions was obtained only for use of District and its consultants, contractors, and tenants for planning and design and is **not** part of the Contract Documents.
- b. District does not warrant, and makes no representation regarding, the accuracy or thoroughness of any information regarding existing conditions. Bidder represents and agrees that in submitting a bid it is not relying on any information regarding existing conditions supplied by District.
- c. Under no circumstances shall District be deemed to warrant or represent existing above-ground conditions, as-built conditions, or other actual conditions, verifiable by independent investigation. These conditions are verifiable by Bidder by the performance of its own independent investigation that Bidder must perform as a condition to bidding and Bidder should not and shall not rely on this information or any other information supplied by District regarding existing conditions.

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- d. Any information shown or indicated in the reports and other data supplied herein with respect to existing underground facilities at or contiguous to the Project may be based upon information and data furnished to District by the District's employees and/or consultants or builders of such underground facilities or others. District does not assume responsibility for the completeness of this information, and Bidder is solely responsible for any interpretation or conclusion drawn from this information.
- e. District shall be responsible only for the general accuracy of information regarding underground facilities, and only for those underground facilities that are owned by District, and only where Bidder has conducted the independent investigation required of it pursuant to the Instructions to Bidders, and discrepancies are not apparent.

4. Investigations/Site Examinations

- a. Before submitting a Bid, each Bidder is responsible for conducting or obtaining any additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and underground facilities) at or contiguous to the Site or otherwise, that may affect cost, progress, performance, or furnishing of Work or that relate to any aspect of the means, methods, techniques, sequences, or procedures of construction to be employed by Bidder and safety precautions and programs incident thereto or that Bidder deems necessary to determine its Bid for performing and furnishing the Work in accordance with the time, price, and other terms and conditions of Contract Documents.
- b. On request, District will provide each Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies, as each Bidder deems necessary for submission of a Bid. Bidders must fill all holes and clean up and restore the Site to its former condition upon completion of its explorations, investigations, tests, and studies. Such investigations and Site examinations may be performed during any and all Site visits indicated in the Notice to Bidders and only under the provisions of the Contract Documents, including, but not limited to, proof of insurance and obligation to indemnify against claims arising from such work, and District's prior approval.

END OF SECTION

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SECTION 00 31 32 – GEOTECHNICAL DATA

1. Summary

This document describes geotechnical data at or near the Project that is in the District's possession available for Contractor's review, and use of data resulting from various investigations. This document is **not** part of the Contract Documents. See General Conditions for definition(s) of terms used herein.

2. Geotechnical Reports

- a. Geotechnical reports may have been prepared for and around the Site and/or in connection with the Work by soil investigation engineers hired by Peralta Community College District ("District"), and its consultants, contractors, and tenants.
- b. Geotechnical reports may be inspected at the District offices or the Construction Manager's offices, if any, and copies may be obtained at cost of reproduction and handling upon Bidder's agreement to pay for such copies. These reports are **not** part of the Contract Documents.
- c. The following reports and drawings of physical conditions that may relate to the Project are for reference only and can be made available to the bidders:
 - (1) Geotechnical Design Report-0034 Merritt Hort Centerdocx final
 - (2) Percolation Test Memo_Merritt Hort Center 9-11-20
 - (3) Surficial Soil Sampling Report-0034 Merritt Hort Center
 - (4) Merritt College - Horticulture Complex HBMS Report_2020_11_19
 - (5) Tech Memo - Greenhouse PCB Sampling_2021_04_01

3. Use of Data

- a. Geotechnical data were obtained only for use of District and its consultants, contractors, and tenants for planning and design and are **not** a part of Contract Documents.
- b. Except as expressly set forth below, District does not warrant, and makes no representation regarding, the accuracy or thoroughness of any geotechnical data. Bidder represents and agrees that in submitting a Bid it is not relying on any geotechnical data supplied by District, except as specifically allowed below.
- c. Under no circumstances shall District be deemed to make a warranty or representation of existing above ground conditions, as-built conditions, geotechnical conditions, or other actual conditions verifiable by independent investigation. These conditions are verifiable by Bidder by the performance of its own independent investigation that Bidder should perform as a condition to bidding and Bidder must not and shall not rely on information supplied by District.

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4. Limited Reliance Permitted on Certain Information

- a. Reference is made herein for identification of:

Reports of explorations and tests of subsurface conditions at or contiguous to the Site that have been utilized by District in preparation of the Contract Documents.

Drawings of physical conditions in or relating to existing subsurface structures (except underground facilities) that are at or contiguous to the Site and have been utilized by District in preparation of the Contract Documents.

- b. Bidder may rely upon the general accuracy of the "technical data" contained in the reports and drawings identified above, but only insofar as it relates to subsurface conditions, provided Bidder has conducted the independent investigation required pursuant to Instructions to Bidders, and discrepancies are not apparent. The term "technical data" in the referenced reports and drawings shall be limited as follows:
- (1) The term "technical data" shall include actual reported depths, reported quantities, reported soil types, reported soil conditions, and reported material, equipment or structures that were encountered during subsurface exploration. The term "technical data" does not include, and Bidder may not rely upon, any other data, interpretations, opinions or information shown or indicated in such drawings or reports that otherwise relate to subsurface conditions or described structures.
 - (2) The term "technical data" shall not include the location of underground facilities.
 - (3) Bidder may not rely on the completeness of reports and drawings for the purposes of bidding or construction. Bidder may rely upon the general accuracy of the "technical data" contained in such reports or drawings.
 - (4) Bidder is solely responsible for any interpretation or conclusion drawn from any "technical data" or any other data, interpretations, opinions, or information provided in the identified reports and drawings.

5. Investigations/Site Examinations

- a. Before submitting a Bid, each Bidder is responsible for conducting or obtaining any additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and underground facilities) at or contiguous to the Site or otherwise, that may affect cost, progress, performance, or furnishing of Work or that relate to any aspect of the means, methods, techniques, sequences, or procedures of construction to be employed by Bidder and safety precautions and programs incident thereto or that Bidder deems necessary to determine its Bid for performing and furnishing the Work in accordance with the time, price, and other terms and conditions of Contract Documents.
- b. On request, District will provide each Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies, as each Bidder deems necessary for submission of a Bid. Bidders must fill all holes and clean up and restore the Site to its former condition upon completion of its explorations, investigations, tests, and studies. Such investigations and Site examinations may be performed during any and all Site visits indicated in the Notice to Bidders and only under the provisions of the

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Contract Documents, including, but not limited to, proof of insurance and obligation to indemnify against claims arising from such work, and District's prior approval.

END OF SECTION

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DOCUMENT 00 41 13
BID FORM AND PROPOSAL

To: Peralta Community College District ("District" or "Owner")

From: _____
 (Proper Name of Bidder)

The undersigned declares that Bidder has read and understands the Contract Documents, including, without limitation, the Notice to Bidders and the Instructions to Bidders, and agrees and proposes to furnish all necessary labor, materials, and equipment to perform and furnish all work in accordance with the terms and conditions of the Contract Documents, including, without limitation, the Drawings and Specifications of Bid No. _____, for the following project known as:

Merritt College New Landscape Horticulture Complex

("Project" or "Contract") and will accept in full payment for that Work the following total lump sum amount, all taxes included:

_____ dollars \$ _____

BASE BID

Bidder acknowledges and agrees that the Base Bid accounts for any and all Allowance(s) and Total Cost for Unit Prices.

Alternate Pricing

Not applicable _____ dollars \$ 0 _____

Additive Alternate #1

NOT USED

_____ dollars \$ _____

Additive Alternate #2

ADDITIONAL GREENHOUSE EQUIPMENT

1.) Base Bid: Refer to Specification Section 13 34 13 – Greenhouses: Equipment fit out for all Greenhouses to be as described in Parts 1-3.

2.) Add Alternate: Refer to Specification Section 13 34 13 – Greenhouses: In addition to equipment specified in Parts 1-3, provide additional equipment as described in Part 4.

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_____ dollars \$ _____

Additive Alternate #3

PAVING TYPE

1.) Base Bid: Refer to Sheet L2.03: Paving Type P-08 to be Core Gravel paving as specified in Section 32 14 43 – Porous Unit Paving.

2.) Add Alternate: Refer Sheets L2.00 and L2.03: Paving Type P-08 to be GrassCrete paving as specified in Section 32 14 43 – Porous Unit Paving.

_____ dollars \$ _____

Additive Alternate #4

GARDEN WATER FOUNTAINS

1.) Base Bid: To each exterior fountain location shown on Sheet L2.02 provide outdoor weatherproof receptacle and irrigation water supply piping with pipe diameter stub out as shown on Irrigation Drawings, and shutoff valve.

2.) Add Alternate: Refer to Specification Section 13 12 13 Exterior Fountains, and Sheets L2.02 and L5.03. Provide Garden Fountains Type A, B, and C. Connect to power and water provided under the Base Bid.

Descriptions of additive alternates are primarily scope definitions and do not necessarily detail the full range of materials and processes needed to complete the construction.

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Additional Detail Regarding Calculation of Base Bid

1. **Unit Prices.** The Bidder's Base Bid includes the following unit prices, which the Bidder must provide and the District may, at its discretion, utilize in valuing additive and/or deductive change orders (Unit Prices shall include all labor, materials, services, profit, overhead, insurance, bonds, taxes, and all other incidental costs of Contractor, subcontractors, and suppliers):

SCHEDULE OF UNIT PRICES

<u>Item No.</u>	<u>Description</u>	<u>Unit of Measure</u>	<u>Estimated Quantity</u>	<u>Unit Price</u>	<u>Total Cost = Unit Price x Estimated Quantity (Included in Base Bid)</u>
1	Drilled Pier. Refer to Structural drawings for location and type of pier.	Linear Foot		\$ _____	\$ _____
2	Remedial Floor Coating or Sheet Membrane. Do not include the cost of the floor coating or underlayment in the base bid; state on the bid form the unit price per square foot for the floor coating or underlayment, installed, in the event such remediation is required. Refer to Specification Section 09 05 61.	Square Foot		\$ _____	\$ _____

Where scope of Work is decreased, all Work pertaining to the item, whether specifically stated or not, shall be omitted, and where scope of Work is increased, all work pertaining to that item required to render same ready for use on the Project in accordance with intentions of the Drawings and Specifications shall be included in the above agreed-upon price amount.

2. The undersigned has reviewed the Work outlined in the Contract Documents and fully understands the scope of Work required in this Proposal, understands the construction and project management function(s) is described in the Contract Documents, and that each Bidder who is awarded a contract shall be in fact a prime contractor, not a subcontractor, to the District, and agrees that its Proposal, if accepted by the District, will be the basis for the Bidder to enter into a contract with the District in accordance with the intent of the Contract Documents.

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3. The undersigned has notified the District in writing of any discrepancies or omissions or of any doubt, questions, or ambiguities about the meaning of any of the Contract Documents, and has contacted the Construction Manager before bid date to verify the issuance of any clarifying Addenda.
4. The undersigned agrees to commence work under this Contract on the date established in the Contract Documents and to complete all work within the time specified in the Contract Documents.
5. The liquidated damages clause of the General Conditions and Agreement is hereby acknowledged.
6. It is understood that the District reserves the right to reject this bid and that the bid shall remain open to acceptance and is irrevocable for a period of ninety (90) days.
7. The following documents are attached hereto:
 - Bid Bond on the District's form or other security
 - Designated Subcontractors List
 - Site Visit Certification
 - Non-Collusion Declaration
 - Iran Contracting Act Certification
 - SLBE/SELBE Self Certification Affidavit

8. Receipt and acceptance of the following Addenda is hereby acknowledged:

No. _____, Dated _____	No. _____, Dated _____
No. _____, Dated _____	No. _____, Dated _____
No. _____, Dated _____	No. _____, Dated _____

9. Bidder acknowledges that the license required for performance of the Work is a B – General Contracting license.
10. Bidder hereby certifies that Bidder is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the Work.
11. Bidder specifically acknowledges and understands that if it is awarded the Contract, that it shall perform the Work of the Project while complying with all requirements of the Department of Industrial Relations.
12. Bidder hereby certifies that its bid includes sufficient funds to permit Bidder to comply with all local, state or federal labor laws or regulations during the Project, including payment of prevailing wage, and that Bidder will comply with the provisions of Labor Code section 2810(d) if awarded the Contract.
13. Bidder agrees to comply with all requirements of the Project Labor Agreement.

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14. The Bidder represents that it is competent, knowledgeable, and has special skills with respect to the nature, extent, and inherent conditions of the Work to be performed. Bidder further acknowledges that there are certain peculiar and inherent conditions existent in the construction of the Work that may create, during the Work, unusual or peculiar unsafe conditions hazardous to persons and property.
15. Bidder expressly acknowledges that it is aware of such peculiar risks and that it has the skill and experience to foresee and to adopt protective measures to adequately and safely perform the Work with respect to such hazards.
16. Bidder expressly acknowledges that it is familiar with and capable of complying with applicable federal, State, and local requirements relating to COVID-19 or other public health emergency/epidemic/pandemic including, if required, preparing, posting, and implementing a Social Distancing Protocol.
17. Bidder expressly acknowledges that it is aware that if a false claim is knowingly submitted (as the terms "claim" and "knowingly" are defined in the California False Claims Act, Gov. Code, § 12650 et seq.), the District will be entitled to civil remedies set forth in the California False Claim Act. It may also be considered fraud and the Contractor may be subject to criminal prosecution.
18. The undersigned Bidder certifies that it is, at the time of bidding, and shall be throughout the period of the Contract, licensed by the State of California to do the type of work required under the terms of the Contract Documents and registered as a public works contractor with the Department of Industrial Relations. Bidder further certifies that it is regularly engaged in the general class and type of work called for in the Contract Documents.

Furthermore, Bidder hereby certifies to the District that all representations, certifications, and statements made by Bidder, as set forth in this bid form, are true and correct and are made under penalty of perjury.

Dated this _____ day of _____ 20 ____

Name of Bidder: _____

Type of Organization: _____

Signed by: _____

Title of Signer: _____

Address of Bidder: _____

Taxpayer Identification No. of Bidder: _____

Telephone Number: _____

Fax Number: _____

E-mail: _____ Web Page: _____

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Contractor's License No(s): No.: _____ Class: _____ Expiration Date: _____

No.: _____ Class: _____ Expiration Date: _____

No.: _____ Class: _____ Expiration Date: _____

Public Works Contractor Registration No.: _____

END OF DOCUMENT

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Issue for Bid		Bid Form and Proposal

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SECTION 00 43 13 - BID BOND

(Note: If Bidder is providing a bid bond as its bid security, Bidder must use this form, NOT a surety company form.)

KNOW ALL PERSONS BY THESE PRESENTS:

That the undersigned, _____, as Principal ("Principal"),

and, _____, as Surety ("Surety"), a corporation organized and existing under and by virtue of the laws of the State of _____ and authorized to do business as a surety in the State of California, are held and firmly bound unto the Peralta Community College District ("District") of Alameda County, State of California, as Obligee, in an amount equal to ten percent (10%) of the Base Bid plus alternates, in the sum of

_____ Dollars (\$ _____)

lawful money of the United States of America, for the payment of which sum well and truly to be made, we, and each of us, bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that whereas the Principal has submitted a bid to the District for all Work specifically described in the accompanying bid for the following project:
_____ ("Project" or "Contract").

NOW, THEREFORE, if the Principal is awarded the Contract and, within the time and manner required under the Contract Documents, after the prescribed forms are presented to Principal for signature, enters into a written contract, in the prescribed form in accordance with the bid, and files two bonds, one guaranteeing faithful performance and the other guaranteeing payment for labor and materials as required by law, and meets all other conditions to the Contract between the Principal and the District becoming effective, or if the Principal shall fully reimburse and save harmless the District from any damage sustained by the District through failure of the Principal to enter into the written contract and to file the required performance and labor and material bonds, and to meet all other conditions to the Contract between the Principal and the District becoming effective, then this obligation shall be null and void; otherwise, it shall be and remain in full force and effect. The full payment of the sum stated above shall be due immediately if Principal fails to execute the Contract within seven (7) days of the date of the District's Notice of Award to Principal.

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, or to the work to be performed thereunder, or the specifications accompanying the same, shall in any way affect its obligation under this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or the call for bids, or to the work, or to the specifications.

In the event suit is brought upon this bond by the District and judgment is recovered, the Surety shall pay all costs incurred by the District in such suit, including a reasonable attorneys' fee to be fixed by the Court.

If the District awards the bid, the security of unsuccessful bidder(s) shall be returned within sixty (60) days from the time the award is made. Unless otherwise required by law, no bidder may withdraw its bid for ninety (90) days after the date of the bid opening.

IN WITNESS WHEREOF, this instrument has been duly executed by the Principal and Surety above named, on the _____ day of _____, 20____.

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Issue for Bid		Bid Bond

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Principal

By

Surety

By

Name of California Agent of Surety

Address of California Agent of Surety

Telephone Number of California Agent of Surety

Bidder must attach Power of Attorney and Certificate of Authority for Surety and a Notarial Acknowledgment for all Surety's signatures. The California Department of Insurance must authorize the Surety to be an admitted Surety Insurer.

END OF SECTION

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Issue for Bid		Bid Bond

(MLH)/Project No. 2463	Peralta Community College District
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SECTION 00 43 36 - DESIGNATED SUBCONTRACTORS LIST

(Public Contract Code Sections 4100-4114)

PROJECT: Merritt College New Landscape Horticulture Complex (MLH)_____

Bidder acknowledges and agrees that it must clearly set forth below the name, location and California contractor license number of each subcontractor who will perform work or labor or render service to the Bidder in or about the construction of the Work or who will specially fabricate and install a portion of the Work according to detailed drawings contained in the plans and specifications in an amount in excess of one-half of one percent (0.5%) of Bidder's total Base Bid and the kind of Work that each will perform. Vendors or suppliers of materials only do not need to be listed.

Bidder acknowledges and agrees that, if Bidder fails to list as to any portion of Work, or if Bidder lists more than one subcontractor to perform the same portion of Work, Bidder must perform that portion itself or be subjected to penalty under applicable law. In case more than one subcontractor is named for the same kind of Work, state the portion of the kind of Work that each subcontractor will perform.

If alternate bid(s) is/are called for and Bidder intends to use subcontractors different from or in addition to those subcontractors listed for work under the Base Bid, Bidder must list subcontractors that will perform Work in an amount in excess of one half of one percent (0.5%) of Bidder's total Base Bid, plus alternate(s).

If further space is required for the list of proposed subcontractors, attach additional copies of page 2 showing the required information, as indicated below.

Subcontractor Name: _____

CA Cont. Lic. #: _____ Location: _____

Portion of Work: _____

Subcontractor Name: _____

CA Cont. Lic. #: _____ Location: _____

Portion of Work: _____

Subcontractor Name: _____

CA Cont. Lic. #: _____ Location: _____

Portion of Work: _____

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Issue for Bid		Designated Subcontractors List

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Subcontractor Name: _____

CA Cont. Lic. #: _____ Location: _____

Portion of Work: _____

Subcontractor Name: _____

CA Cont. Lic. #: _____ Location: _____

Portion of Work: _____

Subcontractor Name: _____

CA Cont. Lic. #: _____ Location: _____

Portion of Work: _____

Subcontractor Name: _____

CA Cont. Lic. #: _____ Location: _____

Portion of Work: _____

Subcontractor Name: _____

CA Cont. Lic. #: _____ Location: _____

Portion of Work: _____

Subcontractor Name: _____

CA Cont. Lic. #: _____ Location: _____

Portion of Work: _____

Subcontractor Name: _____

CA Cont. Lic. #: _____ Location: _____

Portion of Work: _____

Date: _____

Proper Name of Bidder: _____

Signature: _____

Print Name: _____

Title: _____

END OF SECTION

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Issue for Bid		Designated Subcontractors List

(MLH)/Project No. 2463	Peralta Community College District
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SECTION 00 45 01 - SITE VISIT CERTIFICATION

TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID
IF SITE VISIT WAS MANDATORY

PROJECT: Merritt College New Landscape Horticulture Complex (MLH)

Check option that applies:

_____ I certify that I visited the Site of the proposed Work, received the attached pages of information, and became fully acquainted with the conditions relating to construction and labor. I fully understand the facilities, difficulties, and restrictions attending the execution of the Work under contract.

_____ I certify that _____ (Bidder's representative) visited the Site of the proposed Work, received the attached _____ pages of information, and became fully acquainted with the conditions relating to construction and labor. The Bidder's representative fully understood the facilities, difficulties, and restrictions attending the execution of the Work under contract.

Bidder fully indemnifies the Peralta Community College District, its Architect, its Engineers, its Construction Manager, and all of their respective officers, agents, employees, and consultants from any damage, or omissions, related to conditions that could have been identified during my visit and/or the Bidder's representative's visit to the Site.

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

Date: _____

Proper Name of Bidder: _____

Signature: _____

Print Name: _____

Title: _____

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Issue for Bid		Site Visit Certification

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ATTACHMENTS:

- 1.
- 2.
- 3.

END OF SECTION

December 3, 2021	2	00 45 01
Issue for Bid		Site Visit Certification

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Issue for Bid		Non-Collusion Declaration

(MLH)/Project No. 2463	Peralta Community College District
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**SECTION 00 45 19.01 - IRAN CONTRACTING ACT CERTIFICATION
(Public Contract Code Sections 2202-2208)**

MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX (MLH)/PROJECT NO. 2463:
_____ between the Peralta Community College District ("District") and
_____ ("Contractor" or "Bidder") ("Contract" or
"Project").

Prior to bidding on or submitting a proposal for a contract for goods or services of \$1,000,000 or more, the bidder/proposer must submit this certification pursuant to Public Contract Code section 2204.

The bidder/proposer must complete **ONLY ONE** of the following two options. To complete OPTION 1, check the corresponding box **and** complete the certification below. To complete OPTION 2, check the corresponding box, complete the certification below, and attach documentation demonstrating the exemption approval.

- ☐ **OPTION 1.** Bidder/Proposer is not on the current list of persons engaged in investment activities in Iran created by the California Department of General Services ("DGS") pursuant to Public Contract Code section 2203(b), and we are not a financial institution extending twenty million dollars (\$20,000,000) or more in credit to another person, for 45 days or more, if that other person will use the credit to provide goods or services in the energy sector in Iran and is identified on the current list of persons engaged in investment activities in Iran created by DGS.
- ☐ **OPTION 2.** Bidder/Proposer has received a written exemption from the certification requirement pursuant to Public Contract Code sections 2203(c) and (d). *A copy of the written documentation demonstrating the exemption approval is included with our bid/proposal.*

CERTIFICATION:

I, the official named below, CERTIFY UNDER PENALTY OF PERJURY, that I am duly authorized to legally bind the bidder/proposer to the OPTION selected above. This certification is made under the laws of the State of California.

<i>Vendor Name/Financial Institution (Printed)</i>	<i>Federal ID Number (or n/a)</i>
<i>By (Authorized Signature)</i>	
<i>Printed Name and Title of Person Signing</i>	<i>Date Executed</i>

END OF SECTION

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Issue for Bid		Iran Contracting Act Certification

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Issue for Bid		Iran Contracting Act Certification

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SECTION 00 45 26 - WORKERS COMPENSATION CERTIFICATION

MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX CENTER (MLH) / PROJECT NO. 2463: _____ between the Peralta Community College District ("District") and _____ ("Contractor" or "Bidder") ("Contract" or "Project").

Labor Code section 3700, in relevant part, 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 by one or more insurers duly authorized to write compensation insurance in this state; and/or
- b. By securing from the Director of Industrial Relations a certificate of consent to self-insure, 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 employees.

I am aware of the provisions of section 3700 of the Labor Code which 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 the Work of this Contract.

Date: _____

Proper Name of Contractor: _____

Signature: _____

Print Name: _____

Title: _____

(In accordance with Labor Code sections 1860 and 1861, the above certificate must be signed and filed with the awarding body prior to performing any Work under this Contract.)

END OF SECTION

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Issue for Bid		Workers Compensation Certification

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Issue for Bid		Workers Compensation Certification

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**SECTION 00 45 46.01 - PREVAILING WAGE AND
RELATED LABOR REQUIREMENTS CERTIFICATION**

PROJECT/CONTRACT NO.: NEW LANDSCAPE HORTICULTURE COMPLEX/PROJECT NO.2463
between the Peralta Community College District ("District") and
("Contractor" or "Bidder") ("Contract" or "Project").

I hereby certify that I will conform to the State of California Public Works Contract requirements regarding prevailing wages, benefits, on-site audits with 48-hours' notice, payroll records, and apprentice and trainee employment requirements, for all Work on the above Project including, without limitation, labor compliance monitoring and enforcement by the Department of Industrial Relations.

Date: _____

Proper Name of Contractor: _____

Signature: _____

Print Name: _____

Title: _____

END OF SECTION

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Issue for Bid		Prevailing Wage and Related Labor Requirements Certification

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Issue for Bid		Prevailing Wage and Related Labor Requirements Certification

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SECTION 00 45 46.03 - DRUG-FREE WORKPLACE CERTIFICATION

MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX (MLH)/PROJECT NO. 2463: _____
 _____ between the Peralta Community College District ("District") and _____
 _____ ("Contractor" or "Bidder") ("Contract" or
 "Project").

This Drug-Free Workplace Certification form is required from the successful Bidder pursuant to Government Code section 8350 et seq., the Drug-Free Workplace Act of 1990. The Drug-Free Workplace Act of 1990 requires that every person or organization awarded a contract or grant for the procurement of any property or service from any state agency must certify that it will provide a drug-free workplace by doing certain specified acts. In addition, the Act provides that each contract or grant awarded by a state agency may be subject to suspension of payments or termination of the contract or grant, and the contractor or grantee may be subject to debarment from future contracting, if the contracting agency determines that specified acts have occurred.

The District is not a "state agency" as defined in the applicable section(s) of the Government Code, but the District is a local agency and community college district under California law and requires all contractors on District projects to comply with the provisions and requirements of the Drug-Free Workplace Act of 1990.

Contractor must also comply with the provisions of Health & Safety Code section 11362.3 which prohibits the consumption or possession of cannabis or cannabis products in any public place, including on campus.

Contractor shall certify that it will provide a drug-free workplace 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 the person's or organization's workplace and specifying actions which will be taken against employees for violations of the prohibition.
- b. Establishing a drug-free awareness program to inform employees about all of the following:
 - (1) The dangers of drug abuse in the workplace.
 - (2) The person's or organization's policy of maintaining a drug-free workplace.
 - (3) The availability of drug counseling, rehabilitation, and employee-assistance programs.
 - (4) The penalties that may be imposed upon employees for drug abuse violations.
- c. Requiring that each employee engaged in the performance of the contract or grant be given a copy of the statement required above, and that, as a condition of employment on the contract or grant, the employee agrees to abide by the terms of the statement.

I, the undersigned, agree to fulfill the terms and requirements of Government Code section 8355 listed above and will publish a statement notifying employees concerning (a) the prohibition of controlled substance at the workplace, (b) establishing a drug-free awareness program, and (c) requiring that each employee engaged in the performance of the Contract be given a copy of the statement required by section 8355(a), and requiring that the employee agree to abide by the terms of that statement.

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I also understand that if the District determines that I have either (a) made a false certification herein, or (b) violated this certification by failing to carry out the requirements of section 8355, that the Contract awarded herein is subject to termination, suspension of payments, or both. I further understand that, should I violate the terms of the Drug-Free Workplace Act of 1990, I may be subject to debarment in accordance with the requirements of the aforementioned Act.

I acknowledge that I am aware of the provisions of and hereby certify that I will adhere to the requirements of the Drug-Free Workplace Act of 1990 and Health and Safety Code section 11362.3.

Date: _____

Proper Name of Contractor: _____

Signature: _____

Print Name: _____

Title: _____

END OF SECTION

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SECTION 00 45 46.04 - TOBACCO-FREE ENVIRONMENT CERTIFICATION

MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX (MLH)/PROJECT NO. 2463 _____
 _____ between the Peralta Community College District ("District") and _____
 _____ ("Contractor" or "Bidder") ("Contract" or
 "Project").

This Tobacco-Free Environment Certification form is required from the successful Bidder.

Pursuant to, without limitation, 20 U.S.C. section 6083, Labor Code section 6400 et seq., Health & Safety Code section 104350 et seq., Business and Professions Code section 22950 et seq., and District Board policies, all District sites, including the Project site, are tobacco-free environments. Smoking and the use of tobacco products by all persons is prohibited on or in District property. District property includes school buildings, school grounds, school-owned vehicles and vehicles owned by others while on District property. The prohibition on smoking includes the use of any electronic smoking device that creates an aerosol or vapor, in any manner or in any form, and the use of any oral smoking device for the purpose of circumventing the prohibition of tobacco smoking. Further, Health & Safety Code section 11362.3 prohibits the smoking or use of cannabis or cannabis products in any place where smoking tobacco is prohibited.

I acknowledge that I am aware of the District's policy regarding tobacco-free environments at District sites, including the Project site and hereby certify that I will adhere to the requirements of that policy and not permit any of my firm's employees, agents, subcontractors, or my firm's subcontractors' employees or agents, to use tobacco and/or smoke on the Project site.

Date: _____

Proper Name of Contractor: _____

Signature: _____

Print Name: _____

Title: _____

END OF SECTION

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SECTION 00 45 46.05 - HAZARDOUS MATERIALS CERTIFICATION

MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX (MLH)/PROJECT NO. 2463:
between the Peralta Community College District ("District") and
("Contractor" or "Bidder") ("Contract" or
"Project").

- Contractor hereby certifies that no asbestos, or asbestos-containing materials, polychlorinated biphenyl (PCB), or any material listed by the federal or state Environmental Protection Agency or federal or state health agencies as a hazardous material, or any other material defined as being hazardous under federal or state laws, rules, or regulations, ("New Hazardous Material"), shall be furnished, installed, or incorporated in any way into the Project or in any tools, devices, clothing, or equipment used to affect any portion of Contractor's work on the Project for District.
- Contractor further certifies that it has instructed its employees with respect to the above-mentioned standards, hazards, risks, and liabilities.
- Asbestos and/or asbestos-containing material shall be defined as all items containing but not limited to chrysotile, crocidolite, amosite, anthophyllite, tremolite, and actinolite. Any or all material containing greater than one-tenth of one percent (0.1%) asbestos shall be defined as asbestos-containing material.
- Any disputes involving the question of whether or not material is New Hazardous Material shall be settled by electron microscopy or other appropriate and recognized testing procedure, at the District's determination. The costs of any such tests shall be paid by Contractor if the material is found to be New Hazardous Material.
- All Work or materials found to be "New Hazardous Material" or Work or material installed with equipment containing "New Hazardous Material" will be immediately rejected and this Work will be removed at Contractor's expense at no additional cost to the District.
- Contractor has read and understood the document titled Hazardous Materials Procedures & Requirements, and shall comply with all the provisions outlined therein. Contractor certifies that it is knowledgeable of, and shall comply with, all laws applicable to the Work, including, but not limited to, all federal, state, and local laws, statutes, standards, rules, regulations, and ordinances applicable to the Work.

Date:

Proper Name of Contractor:

Signature:

Print Name:

Title:

END OF SECTION

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Issue for Bid		Hazardous Materials Certification

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Issue for Bid		Hazardous Materials Certification

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SECTION 00 45 46.06 - LEAD-BASED MATERIALS CERTIFICATION

MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX (MLH)/PROJECT NO. 2463:
 _____ between the Peralta Community College District ("District") and
 _____ ("Contractor" or "Bidder") ("Contract" or
 "Project").

This certification provides notice to the Contractor that:

- (1) Contractor's work may disturb lead-containing building materials.
- (2) Contractor shall notify the District if any work may result in the disturbance of lead-containing building materials.
- (3) Contractor shall comply with the Renovation, Repair and Painting Rule, if lead-based paint is disturbed in a six-square-foot or greater area indoors or a 20-square-foot or greater area outdoors.

1. Lead as a Health Hazard

Lead poisoning is recognized as a serious environmental health hazard facing children today. Even at low levels of exposure, much lower than previously believed, lead can impair the development of a child's central nervous system, causing learning disabilities, and leading to serious behavioral problems. Lead enters the environment as tiny lead particles and lead dust disburse when paint chips, chalks, peels, wears away over time, or is otherwise disturbed. Ingestion of lead dust is the most common pathway of childhood poisoning; lead dust gets on a child's hands and toys and then into a child's mouth through common hand-to-mouth activity. Exposures may result from construction or remodeling activities that disturb lead paint, from ordinary wear and tear of windows and doors, or from friction on other surfaces.

Ordinary construction and renovation or repainting activities carried out without lead-safe work practices can disturb lead-based paint and create significant hazards. Improper removal practices, such as dry scraping, sanding, or water blasting painted surfaces, are likely to generate high volumes of lead dust.

Because the Contractor and its employees will be providing services for the District, and because the Contractor's work may disturb lead-containing building materials, CONTRACTOR IS HEREBY NOTIFIED of the potential presence of lead-containing materials located within certain buildings utilized by the District. All school buildings built prior to 1978 are presumed to contain some lead-based paint until sampling proves otherwise.

2. Overview of Law

Both the Federal Occupational Safety and Health Administration ("Fed/OSHA") and the California Division of Occupational Safety and Health ("Cal/OSHA") have implemented safety orders applicable to all construction work where a contractor's employee may be occupationally exposed to lead.

The OSHA Regulations apply to all construction work where a contractor's employee may be occupationally exposed to lead. The OSHA Regulations contain specific and detailed requirements imposed on contractors subject to those regulations. The OSHA Regulations define construction work as work for construction, alteration, and/or repair, including painting and decorating. Regulated construction work includes, but is not limited to, the following:

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Issue for Bid		Lead-Based Materials Certification

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- a. Demolition or salvage of structures where lead or materials containing lead are present;
- b. Removal or encapsulation of materials containing lead;
- c. New construction, alteration, repair, or renovation of structures, substrates, or portions thereof, that contain lead, or materials containing lead;
- d. Installation of products containing lead;
- e. Lead contamination/emergency cleanup;
- f. Transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed; and
- g. Maintenance operations associated with the construction activities described in the subsection.

Because it is assumed by the District that all painted surfaces (interior as well as exterior) within the District contain some level of lead, it is imperative that the Contractor, its workers and subcontractors fully and adequately comply with all applicable laws, rules and regulations governing lead-based materials (including title 8, California Code of Regulations, section 1532.1).

Contractor shall notify the District if any Work may result in the disturbance of lead-containing building materials. Any and all Work that may result in the disturbance of lead-containing building materials shall be coordinated through the District. A signed copy of this Certification shall be on file prior to beginning Work on the Project, along with all current insurance certificates.

3. Renovation, Repair and Painting Rule, Section 402(c)(3) of the Toxic Substances Control Act

The EPA requires lead safe work practices to reduce exposure to lead hazards created by renovation, repair and painting activities that disturb lead-based paint. Pursuant to the Renovation, Repair and Painting Rule (RRP), renovations in homes, childcare facilities, and schools built prior to 1978 must be conducted by certified renovations firms, using renovators with training by a EPA-accredited training provider, and fully and adequately complying with all applicable laws, rules and regulations governing lead-based materials, including those rules and regulations appearing within title 40 of the Code of Federal Regulations as part 745 (40 CFR 745).

The RRP requirements apply to all contractors who disturb lead-based paint in a six-square-foot or greater area indoors or a 20-square-foot or greater area outdoors. If a DPH-certified inspector or risk assessor determines that a home constructed before 1978 is lead-free, the federal certification is not required for anyone working on that particular building.

4. Contractor's Liability

If the Contractor fails to comply with any applicable laws, rules, or regulations, and that failure results in a site or worker contamination, the Contractor will be held solely responsible for all costs involved in any required corrective actions, and shall defend, indemnify, and hold harmless the District, pursuant to the indemnification provisions of the Contract, for all damages and other claims arising therefrom.

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If lead disturbance is anticipated in the Work, only persons with appropriate accreditation, registrations, licenses, and training shall conduct this Work.

It shall be the responsibility of the Contractor to properly dispose of any and all waste products, including, but not limited to, paint chips, any collected residue, or any other visual material that may occur from the prepping of any painted surface. It will be the responsibility of the Contractor to provide the proper disposal of any hazardous waste by a certified hazardous waste hauler. This company shall be registered with the Department of Transportation (DOT) and shall be able to issue a current manifest number upon transporting any hazardous material from any school site within the District.

The Contractor shall provide the District with any sample results prior to beginning Work, during the Work, and after the completion of the Work. The District may request to examine, prior to the commencement of the Work, the lead training records of each employee of the Contractor.

THE CONTRACTOR HEREBY ACKNOWLEDGES, UNDER PENALTY OF PERJURY, THAT IT:

1. HAS RECEIVED NOTIFICATION OF POTENTIAL LEAD-BASED MATERIALS ON THE OWNER'S PROPERTY;
2. IS KNOWLEDGEABLE REGARDING AND WILL COMPLY WITH ALL APPLICABLE LAWS, RULES, AND REGULATIONS GOVERNING WORK WITH, AND DISPOSAL, OF LEAD.

THE UNDERSIGNED WARRANTS THAT HE/SHE HAS THE AUTHORITY TO SIGN ON BEHALF OF AND BIND THE CONTRACTOR. THE DISTRICT MAY REQUIRE PROOF OF SUCH AUTHORITY.

Date: _____

Proper Name of Contractor: _____

Signature: _____

Print Name: _____

Title: _____

END OF SECTION

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Issue for Bid		Lead-Based Materials Certification

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Issue for Bid		Lead-Based Materials Certification

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SECTION 00 45 46.07 - IMPORTED MATERIALS CERTIFICATION

MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX (MLH)/PROJECT NO. 2463:
 _____ between the Peralta Community College District ("District") and
 _____ ("Contractor" or "Bidder") ("Contract" or
 "Project").

This form shall be executed by all entities that, in any way, provide or deliver and/or supply any soils, aggregate, or related materials ("Fill") to the Project Site and shall be provided to the District at least ten (10) days before delivery. All Fill shall satisfy all requirements of any environmental review of the Project performed pursuant to the statutes and guidelines of the California Environmental Quality Act, section 21000 et seq. of the Public Resources Code ("CEQA"), and all requirements of section 17210 et seq. of the Education Code, including requirements for a Phase I environmental assessment acceptable to the State of California Community Colleges Chancellor's Office and Department of Toxic Substances Control.

Certification of: ☐ Delivery Firm/Transporter ☐ Supplier ☐ Manufacturer
☐ Wholesaler ☐ Broker ☐ Retailer
☐ Distributor ☐ Other _____

Type of Entity ☐ Corporation ☐ General Partnership
☐ Limited Partnership ☐ Limited Liability Company
☐ Sole Proprietorship ☐ Other _____

Name of firm ("Firm"): _____

Mailing address: _____

Addresses of branch office used for this Project: _____

If subsidiary, name and address of parent company: _____

By my signature below, I hereby certify that I am aware of section 25260 of the Health and Safety Code and the sections referenced therein regarding the definition of hazardous material. I further certify on behalf of the Firm that all soils, aggregates, or related materials provided, delivered, and/or supplied or that will be provided, delivered, and/or supplied by this Firm to the Project Site are free of any and all hazardous material as defined in section 25260 of the Health and Safety Code. I further certify that I am authorized to make this certification on behalf of the Firm.

Date: _____

Proper Name of Firm: _____

Signature: _____

Print Name: _____

Title: _____

END OF SECTION

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Issue for Bid		Imported Materials Certification

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Issue for Bid		Imported Materials Certification

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SECTION 00 45 46.08 - SEX OFFENDER REGISTRATION ACT CERTIFICATION

MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX (MLH)/PROJECT NO. 2463: _____
 _____ between the Peralta Community College District ("District") and _____
 _____ ("Contractor" or "Bidder") ("Contract" or
 "Project").

This certification provides notice to the Contractor that:

- Penal Code section 290.001 requires every person required to register pursuant to sections 290 to 290.009, inclusive, of the Sex Offender Registration Act who is carrying on a vocation at the community college for more than fourteen (14) days, or for an aggregate period exceeding thirty (30) days in a calendar year, shall, in addition to the registration required by the Sex Offender Registration Act, register with the campus police department within five (5) working days of commencing employment at that community college on a form as may be required by the Department of Justice. The terms "employed or carries on a vocation" include employment whether or not financially compensated, volunteered, or performed for government or educational benefit.
- If the community college has no campus police department, the registrant shall instead register with the police of the city in which the campus is located or the sheriff of the county in which the campus is located if the campus is located in an unincorporated area or in a city that has no police department, on a form as may be required by the Department of Justice.
- The registrant shall also notify the campus police department within five (5) working days of ceasing to be employed, or ceasing to carry on a vocation, at the community college.

Contractor hereby acknowledges, under penalty of perjury, that it is aware of the provisions of section 290.001 of the Penal Code, and it will provide notice of the above provisions to all of its employees, subcontractors, and employees of subcontractors regardless of whether they are designated as employees or acting as independent contractors of the Contractor at least five (5) working days before commencing the performance of the Work of this Contract.

THE UNDERSIGNED WARRANTS THAT HE/SHE HAS THE AUTHORITY TO SIGN ON BEHALF OF AND BIND THE CONTRACTOR. THE DISTRICT MAY REQUIRE PROOF OF SUCH AUTHORITY.

Date: _____

Proper Name of Contractor: _____

Signature: _____

Print Name: _____

Title: _____

END OF SECTION

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Issue for Bid		Sex Offender Registration Act Certification

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Issue for Bid		Sex Offender Registration Act Certification

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SECTION 00 45 46.09 - BUY AMERICAN CERTIFICATION

MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX (MLH)/PROJECT NO. 2463: _____
 _____ between the Peralta Community College District ("District") and _____
 _____ ("Contractor" or "Bidder") ("Contract" or
 "Project").

Federal regulations require that all of the iron, steel, and manufactured goods used in projects for the construction, installation, repairs, renovation, modernization, or maintenance of a public building or public work funded in part or in whole by federal stimulus funds, with the exception of projects funded by Qualified School Construction Bonds, be produced in the United States of America, unless a federal department waives this requirement because (1) it is inconsistent with the public interest, (2) the goods are not produced in sufficient quantities or of satisfactory quality in the United States, or (3) the requirement would increase the cost of the Project overall by more than twenty-five percent (25%) ("Buy American").

Contractor shall submit this Certification with its executed agreement, identifying the steps Contractor will take to use goods produced in the United States of America in carrying out this Contract. Bidder should not submit this form with its bid.

Contractor shall retain a copy of this form and may be subject to a future audit.

CERTIFICATION

On behalf of Contractor, I represent and covenant that Contractor will use on the Project only iron, steel and manufactured goods produced in the United States of America except goods for which a federal department has waived this requirement.

I, _____, certify that I am the Contractor's _____
 _____ and that the representations and covenants made herein are true and
 correct. In making this certification, I am aware of section 12650 et seq. of the Government Code
 providing for the imposition of treble damages for making false claims.

Date: _____

Proper Name of Contractor: _____

Signature: _____

Print Name: _____

Title: _____

END OF SECTION

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Issue for Bid		Buy American Certification

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Issue for Bid		Buy American Certification

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SECTION 00 45 46.11 – SMALL LOCAL BUSINESS ENTERPRISE AND EMERGING ENTERPRISE PROGRAM



Peralta Community College District

The District is committed to ensure equal opportunity and equitable treatment in awarding and managing its public contracts and has established an annual overall program goal of twenty-five percent participation for small local businesses. To facilitate opportunities for small local business, the District will use a maximum 5% bidding preference for SLBE and SELBE firms. The preference is only used for computation purposes to determine the winning bidder, the contract is awarded at the actual bid amount. Please review the following guidelines to see if your firm qualifies for the preference.

The 5% bidding preference for an SLBE and SELBE firms are for construction, personal and professional services, goods and services, maintenance, repairs, and operations where responsibility and quality are equal. The preference will be 5% of the bid amount of the lowest responsive responsible bidder, and may not exceed \$50,000.00 for any bid.

A Non-SLBE/SELBE Prime Contractor who utilizes 25% of total bid amount, with SLBE or SELBE subcontractors (who meet the District's Definition of an SLBE and SELBE), can also receive a maximum of 4% bidding preference, not to exceed \$50,000.00 for any bid. (See below Subcontractor section.)

Definitions:

SLBE: A Small Local Business Enterprise is a business that has not exceeded gross annual revenue of 8.5 million dollars for a construction firm, or 6 million dollars for goods and non- professional services firm, or 3 million dollars for architecture, engineering and professional services firm, for the past three consecutive years and meets the below geographic location requirements.

SELBE: A Small Local Emerging Business Enterprise is a business that has not exceeded gross annual revenue of 1.5 million dollars for the past three consecutive years and meets the below geographic location requirements.

Commercially Useful Function: Shall mean a business is directly responsible for providing the materials, equipment, supplies or services to the District as required by the contract solicitation. The business performs work that is normal for its business services and carries out its obligation by actually performing, managing, or supervising the work involved. The business is not Commercially Useful if its role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of SLBE or SELBE participation.

Geographic Location Requirements:

- The business must be located at a fixed, established commercial address located in the District's market area of Albany, Alameda, Berkeley, Emeryville, Oakland, or Piedmont, and not a temporary or movable office, a post office box, or a telephone answering service.
- If the business has an office outside of the District's market area as well as an office within the market area, the office within the District's market area must be staffed on a full time permanent basis with someone employed by the business.
- If requested, the business that has an office outside of the District's market area must provide proof of one or more past contracts citing the business address (such as contracts to perform work, to rent space or equipment, or for other business services) was within the

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Issue for Bid		SLBE-SELBE Self Certification Program

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N&T 22003	Oakland, California

District's market area at least one (1) year prior to the date of contract award. The one-year requirement does not apply to businesses whose sole establishment is located within the District's market area.

Subcontractors:

Non-SLBE/SELBE Prime Contractors who use subcontractors, who meet the district definitions of SLBE and SELBE, may receive a maximum of 4% bidding preference if the following conditions are met:

1. 25% of total bid amount is with Subcontractors who meet the District's definition of an SLBE and SELBE. The Prime Contractor must list each Subcontractor on the Subcontractor List form, clearly identifying the SLBE and SELBE status and the Dollar Amount of work each subcontractor will perform.
2. The Subcontractors must provide a Commercially Useful Function.
3. The Prime Contractor must maintain the Subcontractor percentages (based on the quoted dollar amounts) indicated in the Subcontractor List form at the time the Contract is awarded and throughout the term of the Contract.
4. The Prime Contractor must fill out sign the SLBE/SELBE Self Certification Affidavit and return it with the bid documents, and 48 hours after the bid opening the Prime Contractor must submit signed SLBE/SELBE Self Certification Affidavit from each of the SLBE and SELBE subcontractors listed in the Subcontractor form. The Subcontractor must agree to provide the requested documentation to verify the SLBE/SELBE status.
5. No Substitutions can be made to the SLBE and SELBE subcontractor without the prior written approval of the District. The District will approve a subcontractor substitution on the following conditions:
 - a. A written statement from the subcontractor agreeing to the substitution.
 - b. When the subcontractor has been given a reasonable opportunity to execute the subcontract, yet fails to, or refuses to execute the subcontract, or refuses to satisfy contractual obligations.
 - c. When the subcontractor becomes insolvent.
 - d. When the District determines the work performed by the subcontractor is not in accordance with the contract agreement, or the subcontractor is substantially and unduly delaying or disrupting the progress of work.

Firms that meet the District criteria for an SLBE and SELBE can complete the below self-certification affidavit signed under penalty of perjury. Firms claiming SLBE and SELBE status in the self-certification affidavit will be required to submit proof of residency and revenue 48 hours after bid opening. Such proof shall consist of a copy of a contract to perform work, to rent space or equipment, or for other business services, executed from their local address, and the firm's tax returns for the past three consecutive years.

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Issue for Bid		SLBE-SELBE Self Certification Program



Peralta Community College District

SLBE/SELBE SELF CERTIFICATION AFFIDAVIT

I certify under penalty of perjury that my firm meets the District's definition of a Small Local Business Enterprise or a Small Emerging Local Business Enterprise and resides in the geographic location of the District's market area and qualifies for the below preference. The maximum preference will be five percent of the bid amount of the lowest responsible bidder, and may not exceed \$50,000.00 for any bid. The preference is only used for computation purposes to determine the winning bidder; the contract is awarded at the actual bid amount. The District's Contract Compliance Office will determine whether this requirement has been fulfilled. Bidders may only claim one of the below preferences.

Certification Status	Preference	Preference Claimed (check only one)
SLBE	5% of lowest bid	
SELBE	5% of lowest bid	
25% of Subcontractors are SLBE/SELBE	4% of lowest bid	
Not a SLBE/SELBE	None	

- I acknowledge and am hereby advised that upon a finding of perjury with the claims made in this self certification affidavit the District is authorized to impose penalties which may include any of the following:
 - Refusal to certify the award of a contract
 - Suspension of a contract
 - Withholding of funds
 - Revision of a contract for material breach of contract
 - Disqualification of my firm from eligibility for providing goods and services to the Peralta Community College District for a period not to exceed five (5) years
- I acknowledge and have been advised and hereby agree that my firm will be required to provide proof (and if applicable, my SLBE and SELBE Subcontractors will provide proof) of the status claimed on this self-certification affidavit 48 hours after bid opening. Proof of status claimed includes tax returns from the previous three years and past contracts to determine the size and geographical location of my firm.
- I declare that the above provisions are attested to under penalty of perjury under the laws of the State of California.

Bid Number: _____ Bid Name: _____

Signed _____

Date _____

Printed or typed name _____

Title _____

Name of Company _____

Telephone _____

Fax _____

Month Day, 2022

3

00 45 46.11

Issue for Bid

SLBE-SELBE Self Certification Program

(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
N&T 22003	Oakland, California

END OF SECTION

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Issue for Bid		SLBE-SELBE Self Certification Program

(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
N&T 22003	Oakland, California

SECTION 00 45 49 - REGISTERED SUBCONTRACTORS LIST

(Labor Code Section 1771.1)

PROJECT: MERRITT COLLEGE LANDSCAPE HORTICULTURE COMPLEX (MLH)

Date Submitted (for Updates): _____

Contractor acknowledges and agrees that it must clearly set forth below the name and Department of Industrial Relations (DIR) registration number of each subcontractor **for all tiers** who will perform work or labor or render service to Contractor or its subcontractors in or about the construction of the Work **at least two (2) weeks before the subcontractor is scheduled to perform work**. This document is to be updated as all tiers of subcontractors are identified.

Contractor acknowledges and agrees that, if Contractor fails to list as to any subcontractor of any tier who performs any portion of Work, the Contract is subject to cancellation and the Contractor will be subjected to penalty under applicable law.

If further space is required for the list of proposed subcontractors, attach additional copies of page 2 showing the required information, as indicated below.

Subcontractor Name: _____

DIR Registration #: _____

Portion of Work: _____

Subcontractor Name: _____

DIR Registration #: _____

Portion of Work: _____

Subcontractor Name: _____

DIR Registration #: _____

Portion of Work: _____

Subcontractor Name: _____

DIR Registration #: _____

Portion of Work: _____

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Issue for Bid		Registered Subcontractors List

(MLH)/Project No. 2463	Peralta Community College District
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Subcontractor Name: _____

DIR Registration #: _____

Portion of Work: _____

Subcontractor Name: _____

DIR Registration #: _____

Portion of Work: _____

Subcontractor Name: _____

DIR Registration #: _____

Portion of Work: _____

Subcontractor Name: _____

DIR Registration #: _____

Portion of Work: _____

Subcontractor Name: _____

DIR Registration #: _____

Portion of Work: _____

Subcontractor Name: _____

DIR Registration #: _____

Portion of Work: _____

Subcontractor Name: _____

DIR Registration #: _____

Portion of Work: _____

Date: _____

Name of Contractor: _____

Signature: _____

Print Name: _____

Title: _____

END OF SECTION

December 3, 2021	2	00 45 49
Issue for Bid		Registered Subcontractors List

(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
N&T 22003	Oakland, California

SECTION 00 45 90 - POST BID INTERVIEW

PART 1 – GENERAL

1.01 SUMMARY

If requested by the District, this Section requires the apparent low bidder to attend and participate in a Post Bid Interview with the Construction Manager, prior to award of any contract by the District. The Post Bid Interview will be scheduled by the Construction Manager within three (3) calendar days after the date of bid.

1.02 REQUIRED ATTENDANCE

- A. A duly authorized representative of the apparent low bidder is required to attend the Post Bid Interview, in person.
- B. The apparent low bidder's authorized representative(s) must have (1) knowledge of how the bid submitted was prepared, (2) the person responsible for supervising performance of the Work, and (3) the authority to bind the apparent low bidder.
- C. Failure to attend the Post Bid Interview as scheduled will be considered just cause for the District to reject the Bid as nonresponsive.

1.03 POST BID INTERVIEW PROCEDURE

- A. The Construction Manager will review the Bid with the attendees.
- B. The Construction Manager will review the Contract Documents with the attendees, including but not limited to:
 - (1) Insurance
 - (2) Bonding
 - (3) Addenda
 - (4) Pre-Bid Clarifications
 - (5) Scope of Work
 - (6) Bid Packages Descriptions
 - (7) Bid Alternates
 - (8) Contract Plans
 - (9) Contract Specifications
 - (10) Project Schedule and Schedule Requirements
 - (11) Critical Dates Requirement for Other Bid Packages
 - (12) Prevailing Wage Requirements

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Issue for Bid		Post Bid Interview

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- (13) Liquidated Damages
- (14) Required Documentation for Contract Administration
- (15) Contract Coordination Requirements

1.04 POST BID INTERVIEW DOCUMENTATION

The Construction Manager will document the Post Bid Interview on the form attached to this Section. Both the apparent low bidder and the Construction Manager are required to sign the Post Bid Interview Documentation.

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Issue for Bid		Post Bid Interview

(MLH)/Project No. 2463	Peralta Community College District
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POST BID INTERVIEW

CONSTRUCTION MANAGER

[Name]

[Address 1]

[Address 2]

[Phone]

[Fax]

BIDDER: _____

DATE: _____ TIME: _____ PHONE: _____

I. INTRODUCTIONS:

A. Present

CONTRACTOR

CONTRACTOR

[CM]

[CM]

II. PROPOSED CONTRACT:

III. PURPOSE OF INTERVIEW IS TO ASSURE A MUTUAL UNDERSTANDING OF THE FOLLOWING:

A. Do you acknowledge submission of a complete and accurate bid? Yes No

B. Do you acknowledge the Bid Document submittal timelines after NOA and NTP and can you meet those timelines? Yes No

C. Do you acknowledge the requirements for the escrow of bid documents? Yes No

D. Are you comfortable with your listed subcontractors? Yes No

IV. CONTRACTUAL REQUIREMENTS:

A. Do you understand you are a prime contractor? Yes No

B. Can you meet specified insurance requirements? Yes No

1. Do any of your policies that require Additional Insured endorsements exceed the minimum coverage requirements? Yes No

2. Are you requesting that the District accept an Umbrella or Excess Liability Insurance Policy to meet the policy limit? Yes No

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Issue for Bid		Post Bid Interview

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3.	Will there be a gap between the per occurrence amount of any underlying policy and the start of the coverage under the Umbrella or Excess Liability Insurance Policy?	Yes	No
C.	Will you provide the Performance Bond and Labor and Material Bond for 100% of the Contract Price as stipulated?	Yes	No
1.	Cost for bond: _____%	Yes	No
2.	Is the cost of your bond in your base bid?	Yes	No
3.	Is your surety licensed to issue bonds in California?	Yes	No
D.	Do you understand the sex offender registration requirements?	Yes	No
E.	Is it understood that all workers must be paid prevailing wage?	Yes	No
F.	Is it understood that all subcontractors of every tier must be registered as a public works contractor with the Department of Industrial Relations?	Yes	No
V. SCOPE OF WORK:			
A.	Acknowledged Receipt of Addenda #1-__	Yes	No
B.	Are the costs for addenda items included in your bid? (if applicable)	Yes	No
C.	Do you have a complete understanding of your Scope of Work under the proposed Agreement?	Yes	No
D.	You have re-reviewed the documents and understand the Scope of the Work. Are there any items that require clarification?	Yes	No
If yes, please identify them.			
1.	_____		

2.	_____		

3.	_____		

Is (are) there additional cost(s) for the above item(s)?		Yes	No

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Issue for Bid		Post Bid Interview

(MLH)/Project No. 2463	Peralta Community College District
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- E. Have you reviewed bid alternative(s) #1-____? (If applicable) Yes No
- F. Are the costs for bid alternatives included in your bid? Yes No
- G. Are the plans and specifications clear and understandable to your satisfaction? Yes No
- H. Do you acknowledge that the time to submit notice of requests for substitution of specified materials has expired? Yes No

VI. SCHEDULE:

- A. Do you acknowledge and agree to the stipulated completion dates and milestones in the contract? Yes No
1. Will you provide a detailed construction schedule to _____ within the required ten (10) days of the Notice to Proceed, per the contract? Yes No
2. Can you meet the submittal deadline? Yes No
3. It is understood that the Project schedule is critical and that that weekend and overtime work may be required to meet the milestones. Yes No
4. It is understood that if rain does occur, then all dewatering and protection of work is required, per the contract. Yes No
If not, what do you believe must change and why? _____

- B. Identify critical materials, deliveries, long lead items and other dependencies, including Owner Furnished items that could affect the completion of your work. Yes No

1. _____
2. _____
3. _____
4. _____
5. _____

- C. Do you understand that there is going to be maintenance and other construction taking place on site during the course of the project? Yes No

VII. EXECUTION OF WORK

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Issue for Bid		Post Bid Interview

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- | | | | |
|----|---|-----|----|
| A. | Do you understand the access to the site? | Yes | No |
| B. | Do you understand the staging area restrictions? | Yes | No |
| C. | Have you included protection of [asphalt, floors, and roofs]? | Yes | No |
| D. | Do you understand that the site is occupied by students, teachers, administrators, parents, etc.? | Yes | No |

VIII. CONTRACTOR COMMENTS/SUGGESTIONS:

1. _____
2. _____
3. _____
4. _____
5. _____

IX. CONTRACTOR

You agree the information contained herein is part of your contractual obligations. Your signature acknowledges your agreement to perform all Work in the Contract Documents, and that costs for all Work are included in your bid.

The foregoing information is true and accurate, and I am authorized to sign as an officer of the company I am representing.

[Company Name]

Signature _____ Title: _____

Date: _____

X. CONSTRUCTION MANAGER

Signature _____ Title: _____

Date: _____

Title of Document: POST BID INTERVIEW

Number of Pages: _____

Date of Document: _____

END OF SECTION

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Issue for Bid		Post Bid Interview

(MLH)/Project No. 2463	Peralta Community College District
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SECTION 00 51 00 - NOTICE OF AWARD

Dated: _____ 20__

To: _____ (Contractor)

To: _____
(Address)

From: Governing Board ("Board") of the Peralta Community College District ("District")

RE: MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX (MLH)/Project No. 2463 ("Project").

Contractor has been awarded the Contract for the above referenced Project on _____, 20__, by action of the District's Board.

The Contract Price is Dollars _____ (\$ _____), and includes alternates.

Three (3) copies of each of the Contract Documents (except Drawings) accompany this Notice of Award. Three (3) sets of the Drawings will be delivered separately or otherwise made available. Additional copies are available at cost of reproduction.

You must comply with the following conditions precedent within **SEVEN (7)** calendar days of the date of this Notice of Award.

The Contractor shall execute and submit the following documents by 5:00 p.m. of the **SEVENTH (7th)** calendar day following the date of the Notice of Award.

- a. Agreement: To be executed by successful Bidder. Submit three (3) copies, each bearing an original signature.
- b. Escrow of Bid Documentation: This must include all required documentation. See document titled Escrow Bid Documentation for more information.
- c. Performance Bond (100%): On the form provided in the Contract Documents and fully executed as indicated on the form.
- d. Payment Bond (Contractor's Labor & Material Bond) (100%): On the form provided in the Contract Documents and fully executed as indicated on the form.
- e. Insurance Certificates and Endorsements as required.
- f. Workers' Compensation Certification.
- g. Prevailing Wage and Related Labor Requirements Certification.
- h. Drug-Free Workplace Certification.
- i. Tobacco-Free Environment Certification.
- j. Hazardous Materials Certification.

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- k. Lead-Based Materials Certification.
- l. Imported Materials Certification.
- m. Sex Offender Registration Act Certification.
- n. Buy American Certification.
- o. SLBE/SELBE Self Certification Affidavit
- p. Registered Subcontractors List: Must include Department of Industrial Relations (DIR) registration number of each subcontractor for all tiers.

Failure to comply with these conditions within the time specified will entitle District to consider your bid abandoned, to annul this Notice of Award, and to declare your Bid Security forfeited, as well as any other rights the District may have against the Contractor.

After you comply with those conditions, District will return to you one fully signed counterpart of the Agreement.

PERALTA COMMUNITY COLLEGE DISTRICT

BY: _____

NAME: _____

TITLE: _____

END OF SECTION

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Issue for Bid		Notice of Award

(MLH)/Project No. 2463	Peralta Community College District
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SECTION 00 52 13 – AGREEMENT FORM – STIPULATED SUM (SINGLE-PRIME CONTRACT)

THIS AGREEMENT IS MADE AND ENTERED INTO THIS _____ DAY OF _____, 20____, by and between the Peralta Community College District (“District”) and _____ (“Contractor”) (“Agreement”).

WITNESSETH: That the parties hereto have mutually covenanted and agreed, and by these presents do covenant and agree with each other, as follows:

- The Work:** Contractor agrees to furnish all tools, equipment, apparatus, facilities, labor, and material necessary to perform and complete in a good and workmanlike manner, the work of the following project:

MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX (MLH) (“Project” or “Contract” or “Work”)

It is understood and agreed that the Work shall be performed and completed as required in the Contract Documents including, without limitation, the Drawings and Specifications and submission of all documents required to secure funding or by the Division of the State Architect for close-out of the Project, under the direction and supervision of, and subject to the approval of, the District or its authorized representative.

- The Contract Documents:** The complete Contract consists of all Contract Documents as defined in the General Conditions and incorporated herein by this reference. Any and all obligations of the District and Contractor are fully set forth and described in the Contract Documents. All Contract Documents are intended to cooperate so that any Work called for in one and not mentioned in the other or vice versa is to be executed the same as if mentioned in all Contract Documents.
- Interpretation of Contract Documents:** Should any question arise concerning the intent or meaning of Contract Documents, including the Drawings or Specifications, the question shall be submitted to the District for interpretation. If a conflict exists in the Contract Documents, valid, written modifications, beginning with the most recent, shall control over this Agreement (if any), which shall control over the Special Conditions, which shall control over any Supplemental Conditions, which shall control over the General Conditions, which shall control over the remaining Division 0 documents, which shall control over Division 1 Documents which shall control over Division 2 through Division 49 documents, which shall control over figured dimensions, which shall control over large-scale drawings, which shall control over small-scale drawings. In the case of a discrepancy or ambiguity solely between and among the Drawings and Specifications, the discrepancy or ambiguity shall be resolved in favor of the interpretation that will provide District with the functionally complete and operable Project described in the Drawings and Specifications. In no case shall a document calling for lower quality and/or quantity material or workmanship control. The decision of the District in the matter shall be final.
- Time for Completion:** It is hereby understood and agreed that the Work under this Contract shall be completed within **540 consecutive calendar days** (“Contract Time”) from the date specified in the District’s Notice to Proceed.
- Completion - Extension of Time:** Should the Contractor fail to complete this Contract, and the Work provided herein, within the time fixed for completion, due allowance being made for the contingencies provided for herein, the Contractor shall become liable to the District for all loss and damage that the District may suffer on account thereof. The Contractor shall coordinate its Work with the Work of all other contractors. The District shall not be liable for delays resulting

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Issue for Bid		Agreement Form – Stipulated Sum (Single-Prime Contract)

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from Contractor's failure to coordinate its Work with other contractors in a manner that will allow timely completion of Contractor's Work. Contractor shall be liable for delays to other contractors caused by Contractor's failure to coordinate its Work with the Work of other contractors.

6. **Liquidated Damages:** Time is of the essence for all work under this Agreement. It is hereby understood and agreed that it is and will be difficult and/or impossible to ascertain and determine the actual damage that the District will sustain in the event of and by reason of Contractor's delay; therefore, Contractor agrees that it shall pay to the District the sum of **two thousand five hundred dollars (\$2,500.00) per day as liquidated damages for each and every day's delay beyond the time herein prescribed in the finishing of each Milestone as identified in Specification Section 01 32 12 Scheduling of Work.**

It is hereby understood and agreed that this amount is not a penalty.

In the event that any portion of the liquidated damages is not paid to the District, the District may deduct that amount from any money due or that may become due the Contractor under this Agreement, and such deduction does not constitute a withholding or penalty. The District's right to assess liquidated damages is as indicated herein and in the General Conditions.

The time during which the Contract is delayed for cause, as hereinafter specified, may extend the time of completion for a reasonable time as the District may grant, provided that Contractor has complied with the claims procedure of the Contract Documents. This provision does not exclude the recovery of damages by either party under other provisions in the Contract Documents.

7. **Loss Or Damage:** The District and its agents and authorized representatives shall not in any way or manner be answerable or suffer loss, damage, expense, or liability for any loss or damage that may happen to the Work, or any part thereof, or in or about the same during its construction and before acceptance, and the Contractor shall assume all liabilities of every kind or nature arising from the Work, either by accident, negligence, theft, vandalism, or any cause whatsoever; and shall hold the District and its agents and authorized representatives harmless from all liability of every kind and nature arising from accident, negligence, or any cause whatsoever.
8. **Limitation Of District Liability:** District's financial obligations under this Contract shall be limited to the payment of the compensation provided in this Contract. Notwithstanding any other provision of this Contract, in no event shall District be liable, regardless of whether any claim is based on contract or tort, for any special, consequential, indirect or incidental damages, including, but not limited to, lost profits or revenue, lost bonding capacity, arising out of or in connection with this Contract for the services performed in connection with this Contract.
9. **Insurance and Bonds:** Prior to issuance of the Notice to Proceed by the District, Contractor shall provide all required certificates of insurance, insurance endorsements, and payment and performance bonds as evidence thereof.
10. **Prosecution of Work:** If the Contractor should neglect to prosecute the Work properly or fail to perform any provisions of this Contract, the District, may, pursuant to the General Conditions and without prejudice to any other remedy it may have, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor.
11. **Authority of Architect, Project Inspector, and DSA:** Contractor hereby acknowledges that the Architect(s), the Project Inspector(s), and the Division of the State Architect ("DSA") have authority to approve and/or suspend Work if the Contractor's Work does not comply with the requirements of the Contract Documents, Title 24 of the California Code of Regulations, and all

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applicable laws and regulations. The Contractor shall be liable for any delay caused by its non-compliant Work.

12. **Assignment of Contract:** Neither the Contract, nor any part thereof, nor any moneys due or to become due thereunder, may be assigned by the Contractor without the prior written approval of the District, nor without the written consent of the Surety on the Contractor's Performance Bond (the "Surety"), unless the Surety has waived in writing its right to notice of assignment.
13. **Classification of Contractor's License:** Contractor hereby acknowledges that it currently holds valid Type B – General Contractor's license(s) issued by the State of California, Contractors' State License Board, in accordance with division 3, chapter 9, of the Business and Professions Code and in the classification called for in the Contract Documents.
14. **Registration as Public Works Contractor:** The Contractor and all Subcontractors currently are registered as public works contractors with the Department of Industrial Relations, State of California, in accordance with Labor Code section 1771.1.
15. **Payment of Prevailing Wages:** The Contractor and all Subcontractors shall pay all workers on all Work performed pursuant to this Contract not less than the general prevailing rate of per diem wages and the general prevailing rate for holiday and overtime work as determined by the Director of the Department of Industrial Relations, State of California, for the type of work performed and the locality in which the work is to be performed within the boundaries of the District, pursuant to sections 1770 et seq. of the California Labor Code.
16. This Project is subject to labor compliance monitoring and enforcement by the Department of Industrial Relations pursuant to Labor Code section 1771.4 and Title 8 of the California Code of Regulations. Contractor specifically acknowledges and understands that it shall perform the Work of this Agreement while complying with all the applicable provisions of Division 2, Part 7, Chapter 1, of the Labor Code, including, without limitation, the requirement that the Contractor and all of its Subcontractors shall timely submit complete and accurate electronic certified payroll records as required by the Contract Documents, or the District may not issue payment.
17. **Contract Price:** In consideration of the foregoing covenants, promises, and agreements on the part of the Contractor, and the strict and literal fulfillment of each and every covenant, promise, and agreement, and as compensation agreed upon for the Work and construction, erection, and completion as aforesaid, the District covenants, promises, and agrees that it will well and truly pay and cause to be paid to the Contractor in full, and as the full Contract Price and compensation for construction, erection, and completion of the Work hereinabove agreed to be performed by the Contractor, the following price:

_____ Dollars

(\$ _____),

in lawful money of the United States, which sum is to be paid according to the schedule provided by the Contractor and accepted by the District and subject to additions and deductions as provided in the Contract. This amount supersedes any previously stated and/or agreed to amount(s).

18. **No Representations:** No representations have been made other than as set forth in writing in the Contract Documents, including this Agreement. Each of the Parties to this Agreement warrants that it has carefully read and understood the terms and conditions of this Agreement and

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Issue for Bid		Agreement Form – Stipulated Sum (Single-Prime Contract)

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all Contract Documents, and that it has not relied upon the representations or advice of any other Party or any attorney not its own.

- 19. Entire Agreement:** The Contract Documents, including this Agreement, set forth the entire agreement between the parties hereto and fully supersede any and all prior agreements, understandings, written or oral, between the parties hereto pertaining to the subject matter thereof.
- 20. Severability:** If any term, covenant, condition, or provision in any of the Contract Documents is held by a court of competent jurisdiction to be invalid, void or unenforceable, the remainder of the provisions in the Contract Documents shall remain in full force and effect and shall in no way be affected, impaired, or invalidated thereby.

IN WITNESS WHEREOF, accepted and agreed on the date indicated above:

CONTRACTOR

PERALTA COMMUNITY COLLEGE DISTRICT

By: _____

By: _____

Title: _____

Title: _____

NOTE: If the party executing this Contract is a corporation, a certified copy of the by-laws, or of the resolution of the Board of Directors, authorizing the officers of said corporation to execute the Contract and the bonds required thereby must be attached hereto.

END OF SECTION

December 3, 2021	4	00 52 13
Issue for Bid		Agreement Form – Stipulated Sum (Single-Prime Contract)

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SECTION 00 55 00- NOTICE TO PROCEED

Dated: _____, 20__

To: _____
 ("Contractor")

Address: _____

Project: MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX (MLH)

PROJECT NO. 2464:

between the Peralta Community College District and Contractor ("Contract").

You are notified that the Contract Time under the above Contract will commence to run on _____, 20__. By that date, you are to start performing your obligations under the Contract Documents. In accordance with the Agreement executed by Contractor, the date of completion is _____, 20__.

You must submit the following documents by 5:00 p.m. of the TENTH (10th) calendar day following the date of this Notice to Proceed:

- a. Contractor's preliminary schedule of construction.
- b. Contractor's preliminary schedule of values for all of the Work.
- c. Contractor's preliminary schedule of submittals, including Shop Drawings, Product Data, and Samples submittals
- d. Contractor's Safety Plan specifically adapted for the Project.
- e. Registered Subcontractors List: A complete subcontractors list for all tiers, including the name, address, telephone number, email address, facsimile number, California State Contractors License number, license classification, Department of Industrial Relations registration number, and monetary value of all Subcontracts.

Thank you. We look forward to a very successful Project.

PERALTA COMMUNITY COLLEGE DISTRICT

BY: _____

NAME: _____

TITLE: _____

END OF SECTION

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Issue for Bid		Notice to Proceed

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SECTION 00 55 00- NOTICE TO PROCEED

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Issue for Bid		Notice to Proceed

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SECTION 00 56 00 - ESCROW BID DOCUMENTATION

1. Requirement to Escrow Bid Documentation

- a. Contractor shall submit, within **SEVEN (7)** calendar days after the date of the Notice of Award, one copy of all documentary information received or generated by Contractor in preparation of bid prices for this Contract, as specified herein. This material is referred to herein as "Escrow Bid Documentation." The Escrow Bid Documentation of the Contractor will be held in escrow for the duration of the Contract.
- b. Contractor agrees, as a condition of award of the Contract, that the Escrow Bid Documentation constitutes all written information used in the preparation of its bid, and that no other written bid preparation information shall be considered in resolving disputes or claims. Contractor also agrees that nothing in the Escrow Bid Documentation shall change or modify the terms or conditions of the Contract Documents.
- c. The Escrow Bid Documentation will not be opened by District except as indicated herein. The Escrow Bid Documentation will be used only for the resolution of change orders and claims disputes.
- d. Contractor's submission of the Escrow Bid Documentation, as with the bonds and insurance documents required, is considered an essential part of the Contract award. Should the Contractor fail to make the submission within the allowed time specified above, District may deem the Contractor to have failed to enter into the Contract, and the Contractor shall forfeit the amount of its bid security, accompanying the Contractor's bid, and District may award the Contract to the next lowest responsive responsible bidder.
- e. NO PAYMENTS WILL BE MADE, NOR WILL DISTRICT ACCEPT PROPOSED CHANGE ORDERS UNTIL THE ABOVE REQUIRED INFORMATION IS SUBMITTED AND APPROVED.
- f. The Escrow Bid Documentation shall be submitted in person by an authorized representative of the Contractor to the District.

2. Ownership of Escrow Bid Documentation

- a. The Escrow Bid Documentation is, and shall always remain, the property of Contractor, subject to review by District, as provided herein.
- b. Escrow Bid Documentation constitute trade secrets, not known outside Contractor's business, known only to a limited extent and only by a limited number of employees of Contractor, safeguarded while in Contractor's possession, extremely valuable to Contractor, and could be extremely valuable to Contractor's competitors by virtue of it reflecting Contractor's contemplated techniques of construction. Subject to the provisions herein, District agrees to safeguard the Escrow Bid Documentation, and all information contained therein, against disclosure to the fullest extent permitted by law.

3. Format and Contents of Escrow Bid Documentation

- a. Contractor may submit Escrow Bid Documentation in its usual cost-estimating format; a standard format is not required. The Escrow Bid Documentation shall be submitted in the language (e.g., English) of the specification.

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Issue for Bid		Escrow Bid Documentation

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- b. Escrow Bid Documentation must clearly itemize the estimated costs of performing the work of each bid item contained in the bid schedule, separating bid items into sub-items as required to present a detailed cost estimate and allow a detailed cost review. The Escrow Bid Documentation shall include all subcontractor bids or quotes, supplier bids or quotes, quantity takeoffs, crews, equipment, calculations of rates of production and progress, copies of quotes from subcontractors and suppliers, and memoranda, narratives, add/deduct sheets, and all other information used by the Contractor to arrive at the prices contained in the bid proposal. Estimated costs should be broken down into Contractor's usual estimate categories such as direct labor, repair labor, equipment ownership and operation, expendable materials, permanent materials, and subcontract costs as appropriate. Plant and equipment and indirect costs should be detailed in the Contractor's usual format. The Contractor's allocation of indirect costs, contingencies, markup, and other items to each bid item shall be identified.
- c. All costs shall be identified. For bid items amounting to less than \$10,000, estimated unit costs are acceptable without a detailed cost estimate, provided that labor, equipment, materials, and subcontracts, as applicable, are included and provided that indirect costs, contingencies, and markup, as applicable, are allocated.
- d. Bid Documentation provided by District should not be included in the Escrow Bid Documentation unless needed to comply with the following requirements.

4. Submittal of Escrow Bid Documentation

- a. The Escrow Bid Documentation shall be submitted by the Contractor in a sealed container within **SEVEN (7)** calendar days after the date of the Notice of Award. The container shall be clearly marked on the outside with the Contractor's name, date of submittal, project name and the words "Escrow Bid Documentation – Intended to be opened in the presence of Authorized Representatives of Both District and Contractor".
- b. By submitting Escrow Bid Documentation, Contractor represents that the material in the Escrow Bid Documentation constitutes all the documentary information used in preparation of the bid and that the Contractor has personally examined the contents of the Escrow Bid Documentation container and has found that the documents in the container are complete.
- c. If Contractor's proposal is based upon subcontracting any part of the work, each subcontractor whose total subcontract price exceeds 5 percent of the total contract price proposed by Contractor, shall provide separate Escrow Documents to be included with those of Contractor. Those documents shall be opened and examined in the same manner and at the same time as the examination described above for Contractor.
- d. If Contractor wishes to subcontract any portion of the Work after award, District retains the right to require Contractor to submit Escrow Documents for the Subcontractor before the subcontract is approved.

5. Storage, Examination and Final Disposition of Escrow Bid Documentation

- a. The Escrow Bid Documentation will be placed in escrow, for the life of the Contract, in a mutually agreeable institution. The cost of storage will be paid by Contractor for the duration of the project until final Contract payment. The storage facilities shall be the appropriate size for all the Escrow Bid Documentation and located conveniently to both District's and Contractor's offices.

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- b. The Escrow Bid Documentation shall be examined by both District and Contractor, at any time deemed necessary by either District or Contractor, to assist in the negotiation of price adjustments and change orders or the settlement of disputes and claims. In the case of legal proceedings, Escrow Bid Documentation shall be used subject to the terms of an appropriate protective order if requested by Contractor and ordered by a court of competent jurisdiction. Examination of the Escrow Bid Documentation is subject to the following conditions:
- (1) As trade secrets, the Escrow Bid Documentation is proprietary and confidential to the extent allowed by law.
 - (2) District and Contractor shall each designate, in writing to the other party **SEVEN (7)** calendar days prior to any examination, the names of representatives who are authorized to examine the Escrow Bid Documentation. No other person shall have access to the Escrow Bid Documentation.
 - (3) Access to the documents may take place only in the presence of duly designated representatives of the District and Contractor. If Contractor fails to designate a representative or appear for joint examination on **SEVEN (7)** calendar days' notice, then the District representative may examine the Escrow Bid Documents alone upon an additional **THREE (3)** calendar days' notice if a representative of the Contractor does not appear at the time set.
 - (4) If a subcontractor has submitted sealed information to be included in the Escrow Bid Documents, access to those documents may take place only in the presence of a duly designated representative of the District, Contractor and that subcontractor. If that subcontractor fails to designate a representative or appear for joint examination on **SEVEN (7)** calendar days' notice, then the District representative and/or the Contractor may examine the Escrow Bid Documentation without that subcontractor present upon an additional **THREE (3)** calendar days' notice if a representative of that subcontractor does not appear at the time set.
- c. The Escrow Bid Documentation will be returned to Contractor at such time as the Contract has been completed and final settlement has been achieved.

END OF SECTION

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**SECTION 00 57 00 - ESCROW AGREEMENT IN LIEU OF RETENTION
(Public Contract Code Section 22300)**

(Note: Contractor must use this form.)

This Escrow Agreement in Lieu of Retention ("Escrow Agreement") is made and entered into this _____ day of _____, 20____, by and between the Peralta Community College District ("District"), whose address is 333 East 8th Street, Oakland, California 94606, and _____ ("Contractor"), whose address is _____, and _____ ("Escrow Agent"), a state or federally chartered bank in the state of California, whose address is _____.

For the consideration hereinafter set forth, District, Contractor, and Escrow Agent agree as follows:

1. Pursuant to section 22300 of Public Contract Code of the State of California, which is hereby incorporated by reference, Contractor has the following two (2) options:

- ☐ Deposit securities with Escrow Agent as a substitute for retention earnings required to be withheld by District pursuant to the Construction Contract No.____ entered into between District and Contractor for the _____ Project, in the amount of _____ Dollars (\$_____) dated, _____, 20____, (the "Contract"); **or**
- ☐ On written request of Contractor, District shall make payments of the retention earnings for the above referenced Contract directly to Escrow Agent.

When Contractor deposits the securities as a substitute for Contract earnings (first option), Escrow Agent shall notify District within ten (10) calendar days of the deposit. The market value of the securities at the time of substitution and at all times from substitution until the termination of the Escrow Agreement shall be at least equal to the cash amount then required to be withheld as retention under the terms of the Contract between District and Contractor.

Securities shall be held in name of Peralta Community College School District, and shall designate Contractor as beneficial owner.

2. District shall make progress payments to Contractor for those funds which otherwise would be withheld from progress payments pursuant to Contract provisions, provided that Escrow Agent holds securities in form and amount specified above.
3. When District makes payment of retention earned directly to Escrow Agent, Escrow Agent shall hold them for the benefit of Contractor until the time that the escrow created under this Escrow Agreement is terminated. Contractor may direct the investment of the payments into securities. All terms and conditions of this Escrow Agreement and the rights and responsibilities of the Parties shall be equally applicable and binding when District pays Escrow Agent directly.
4. Contractor shall be responsible for paying all fees for the expenses incurred by Escrow Agent in administering the Escrow Account, and all expenses of District. The District will charge Contractor \$_____ for each of District's deposits to the escrow account. These expenses and payment terms shall be determined by District, Contractor, and Escrow Agent.

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5. Interest earned on securities or money market accounts held in escrow and all interest earned on that interest shall be for sole account of Contractor and shall be subject to withdrawal by Contractor at any time and from time to time without notice to District.
6. Contractor shall have the right to withdraw all or any part of the principal in the Escrow Account only by written notice to Escrow Agent accompanied by written authorization from District to Escrow Agent that District consents to withdrawal of amount sought to be withdrawn by Contractor.
7. District shall have the right to draw upon the securities and/or withdraw amounts from the Escrow Account in the event of default by Contractor. Upon seven (7) days' written notice to Escrow Agent from District of the default, if applicable, Escrow Agent shall immediately convert the securities to cash and shall distribute the cash as instructed by District. Escrow Agent shall not be authorized to determine the validity of any notice of default given by District pursuant to this paragraph, and shall promptly comply with District's instructions to pay over said escrowed assets. Escrow Agent further agrees to not interplead the escrowed assets in response to a conflicting demand.
8. Upon receipt of written notification from District certifying that the Contract is final and complete, and that Contractor has complied with all requirements and procedures applicable to the Contract, Escrow Agent shall release to Contractor all securities and interest on deposit less escrow fees and charges of the Escrow Account. The escrow shall be closed immediately upon disbursement of all monies and securities on deposit and payments of fees and charges.
9. Escrow Agent shall rely on written notifications from District and Contractor pursuant to Paragraphs 5 through 8, inclusive, of this Escrow Agreement and District and Contractor shall hold Escrow Agent harmless from Escrow Agent's release and disbursement of securities and interest as set forth above.

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10. Names of persons who are authorized to give written notice or to receive written notice on behalf of District and on behalf of Contractor in connection with the foregoing, and exemplars of their respective signatures are as follows:

On behalf of District:

On behalf of Contractor:

Title

Title

Name

Name

Signature

Signature

Address

Address

On behalf of Escrow Agent:

Title

Name

Signature

Address

At the time that the Escrow Account is opened, District and Contractor shall deliver to Escrow Agent a fully executed copy of this Agreement.

IN WITNESS WHEREOF, the parties have executed this Agreement by their proper officers on the date first set forth above.

On behalf of District:

On behalf of Contractor:

Title

Title

Name

Name

Signature

Signature

Address

Address

END OF SECTION

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**SECTION 00 61 13.13 - PERFORMANCE BOND
(100% of Contract Price)**

(Note: Contractor must use this form, NOT a surety company form.)

KNOW ALL PERSONS BY THESE PRESENTS:

WHEREAS, the governing board ("Board") of the Peralta Community College District ("District") and ("Principal") have entered into a contract for the furnishing of all materials and labor, services and transportation, necessary, convenient, and proper to perform the following project: MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX (MLH) ("Project" or "Contract") which Contract dated , 20 __, and all of the Contract Documents attached to or forming a part of the Contract, are hereby referred to and made a part hereof; and

WHEREAS, said Principal is required under the terms of the Contract to furnish a bond for the faithful performance of the Contract.

NOW, THEREFORE, the Principal and _____ ("Surety") are held and firmly bound unto the Board of the District in the penal sum of _____ Dollars (\$ _____), lawful money of the United States, for the payment of which sum well and truly to be made we bind ourselves, our heirs, executors, administrators, successors, and assigns jointly and severally, firmly by these presents, to:

- Promptly perform all the work required to complete the Project; and
- Pay to the District all damages the District incurs as a result of the Principal's failure to perform all the Work required to complete the Project.

Or, at the District's sole discretion and election, the Surety shall obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by the District of the lowest responsible bidder, arrange for a contract between such bidder and the District and make available as Work progresses sufficient funds to pay the cost of completion less the "balance of the Contract Price," and to pay and perform all obligations of Principals under the Contract, including, without limitation, all obligations with respect to warranties, guarantees and the payment of liquidated damages. The term "balance of the Contract Price," as used in this paragraph, shall mean the total amount payable to Principal by the District under the Contract and any modifications thereto, less the amount previously paid by the District to the Principal, less any withholdings by the District allowed under the Contract. District shall not be required or obligated to accept a tender of a completion contractor from the Surety for any or no reason.

The condition of the obligation is such that, if the above bound Principal, its heirs, executors, administrators, successors, or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions, and agreements in the Contract and any alteration thereof made as therein provided, on its part to be kept and performed at the time and in the intent and meaning, including all contractual guarantees and warranties of materials and workmanship, and shall indemnify and save harmless the District, its trustees, officers and agents, as therein stipulated, then this obligation shall become null and void, otherwise it shall be and remain in full force and virtue.

Surety expressly agrees that the District may reject any contractor or subcontractor proposed by Surety to fulfill its obligations in the event of default by the Principal. Surety shall not utilize Principal in completing the Work nor shall Surety accept a Bid from Principal for completion of the Work if the District declares

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Issue for Bid		Performance Bond

(MLH)/Project No. 2463	Peralta Community College District
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the Principal to be in default and notifies Surety of the District's objection to Principal's further participation in the completion of the Work.

As a condition precedent to the satisfactory completion of the Contract, the above obligation shall hold good for a period equal to the warranty and/or guarantee period of the Contract, during which time Surety's obligation shall continue if Contractor shall fail to make full, complete, and satisfactory repair and replacements and totally protect the District from loss or damage resulting from or caused by defective materials or faulty workmanship. The obligations of Surety hereunder shall continue so long as any obligation of Contractor remains. Nothing herein shall limit the District's rights or the Contractor or Surety's obligations under the Contract, law or equity, including, but not limited to, California Code of Civil Procedure section 337.15.

The Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of the contract or to the work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on this bond. The Surety also stipulates and agrees that it shall not be exonerated or released from the obligation of this bond by any overpayment or underpayment by the District that is based upon estimates approved by the Architect. The Surety does hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the Contract or to the work or to the specifications.

IN WITNESS WHEREOF, two (2) identical counterparts of this instrument, each of which shall for all purposes be deemed an original thereof, have been duly executed by the Principal and Surety above named, on the _____ day of _____, 20____.

Principal	Surety
By	By
	Name of California Agent of Surety
	Address of California Agent of Surety
	Telephone No. of California Agent of Surety

Contractor must attach a Notarial Acknowledgment for all Surety's signatures and a Power of Attorney and Certificate of Authority for Surety. The California Department of Insurance must authorize the Surety to be an admitted surety insurer.

END OF SECTION

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Issue for Bid		Performance Bond

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SECTION 00 61 13.16 - PAYMENT BOND

Contractor's Labor & Material Bond (100% Of Contract Price)

(Note: Contractor must use this form, NOT a surety company form.)

KNOW ALL PERSONS BY THESE PRESENTS:

WHEREAS, the governing board ("Board") of the Peralta Community College District, ("District") and _____, ("Principal") have entered into a contract for the furnishing of all materials and labor, services and transportation, necessary, convenient, and proper to perform the following project:

MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX (MLH) which Contract dated _____, 20____, and all of the Contract Documents attached to or forming a part of the Contract, are hereby referred to and made a part hereof; and

WHEREAS, pursuant to law and the Contract, the Principal is required, before entering upon the performance of the work, to file a good and sufficient bond with the body by which the Contract is awarded in an amount equal to one hundred percent (100%) of the Contract price, to secure the claims to which reference is made in sections 9000 through 9510 and 9550 through 9566 of the Civil Code, and division 2, part 7, of the Labor Code.

NOW, THEREFORE, the Principal and _____ ("Surety") are held and firmly bound unto all laborers, material men, and other persons referred to in said statutes in the sum of _____ Dollars (\$ _____), lawful money of the United States, being a sum not less than the total amount payable by the terms of Contract, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, or assigns, jointly and severally, by these presents.

The condition of this obligation is that if the Principal or any of its subcontractors, or the heirs, executors, administrators, successors, or assigns of any, all, or either of them shall fail to pay for any labor, materials, provisions, or other supplies, used in, upon, for or about the performance of the work contracted to be done, or for any work or labor thereon of any kind, or for amounts required to be deducted, withheld, and paid over to the Employment Development Department from the wages of employees of the Principal or any of its subcontractors of any tier under Section 13020 of the Unemployment Insurance Code with respect to such work or labor, that the Surety will pay the same in an amount not exceeding the amount herein above set forth, and also in case suit is brought upon this bond, will pay a reasonable attorney's fee to be awarded and fixed by the court, and to be taxed as costs and to be included in the judgment therein rendered.

It is hereby expressly stipulated and agreed that this bond shall inure to the benefit of any and all persons, companies, and corporations entitled to file claims under section 9100 of the Civil Code, so as to give a right of action to them or their assigns in any suit brought upon this bond.

Should the condition of this bond be fully performed, then this obligation shall become null and void; otherwise it shall be and remain in full force and affect.

And the Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of Contract or the specifications accompanying the same shall in any manner affect its obligations on this bond, and it does hereby waive notice of any such change, extension, alteration, or addition.

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Issue for Bid		Payment Bond

(MLH)/Project No. 2463	Peralta Community College District
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IN WITNESS WHEREOF, two (2) identical counterparts of this instrument, each of which shall for all purposes be deemed an original thereof, have been duly executed by the Principal and Surety above named, on the _____ day of _____, 20____.

_____ Principal	_____ Surety
_____ By	_____ By
	_____ Name of California Agent of Surety
	_____ Address of California Agent of Surety
	_____ Telephone No. of California Agent of Surety

Contractor must attach a Notarial Acknowledgment for all Surety's signatures and a Power of Attorney and Certificate of Authority for Surety. The California Department of Insurance must authorize the Surety to be an admitted surety insurer.

END OF SECTION

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Issue for Bid		Payment Bond

(MLH)/Project No. 2463	Peralta Community College District
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N&T 22003	Oakland, California

SECTION 00 63 40 – ALLOWANCE EXPENDITURE DIRECTIVE FORM

Peralta Community College District
333 East 8th Street
Oakland, CA 94606

**ALLOWANCE EXPENDITURE
DIRECTIVE NO.:**

ALLOWANCE EXPENDITURE DIRECTIVE

Project:
Bid No.:

Date:
DSA File No.:
DSA Appl. No.:

The following parties agree to the terms of this Allowance Expenditure Directive ("AED"):

Owner Name, Address, Telephone:

Contractor Name, Address, Telephone:

Reference	Description	Allowance Authorized for Expenditure
Request for AED # Requested by: Performed by: Reason:	[Description of unforeseen item relating to Work] [Requester] [Performer] [Reason]	\$
Request for AED # Requested by: Performed by: Reason:	[Description of unforeseen item relating to Work] [Requester] [Performer] [Reason]	\$
Request for AED # Requested by: Performed by: Reason:	[Description of unforeseen item relating to Work] [Requester] [Performer] [Reason]	\$

Total Contract Allowance Amount:	\$
Amount of Previously Approved Allowance Expenditure Directive(s):	\$
Amount of this Allowance Expenditure Directive:	\$

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The undersigned Contractor approves the foregoing release of allowance for completion of each specified item, and agrees to furnish all labor, materials and services and perform all work necessary to complete any additional work specified for the consideration stated therein ("Work"). Submission of sums which have no basis in fact or which Contractor knows are false are at the sole risk of Contractor and may be a violation of the False Claims Act set forth under Government Code section 12650, et seq.

This Allowance Expenditure Directive must be signed by an authorized District representative.

It is expressly understood that the authorized allowance expenditure granted herein represent a full accord and satisfaction for any and all cost impacts of the items herein, and Contractor waives any and all further compensation based on the items herein. The value of the extra work or changes expressly includes any and all of the Contractor's costs and expenses, and its subcontractors, both direct and indirect. Any costs, expenses, or damages not included are deemed waived.

Signatures:

DISTRICT: PERALTA _____ DISTRICT Date: _____ By: _____ [Print Name and Title here]	CONTRACTOR: _____ Date: _____ By: _____ [Print Name and Title here]
ARCHITECT: _____ Date: _____ By: _____ [Print Name and Title here]	PROJECT INSPECTOR: _____ Date: _____ By: _____ [Print Name and Title here]

END OF SECTION

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Issue for Bid		Allowance Expenditure Directive Form

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SECTION 00 63 57 - PROPOSED CHANGE ORDER FORM

Peralta Community College District
333 East 8th Street
Oakland, CA 94606

PCO NO.:

Project:
Bid No.:
RFI #:

Date:
DSA File No.:
DSA Appl. No.:

Contractor hereby submits for District's review and evaluation this Proposed Change Order ("PCO"), submitted in accordance with and subject to the terms of the Contract Documents, including Sections 17.7 and 17.8 of the General Conditions. Any spaces left blank below are deemed no change to cost or time.

Contractor understands and acknowledges that documentation supporting Contractor's PCO must be attached and included for District review and evaluation. Contractor further understands and acknowledges that failure to include documentation sufficient to, in District's discretion, support some or all of the PCO, shall result in a rejected PCO.

	WORK PERFORMED OTHER THAN BY CONTRACTOR	ADD	DEDUCT
(a)	Material (attach suppliers' invoice or itemized quantity and unit cost plus sales tax)		
(b)	Add Labor (attach itemized hours and rates, fully encumbered)		
(c)	Add Equipment (attach suppliers' invoice)		
(d)	Subtotal		
(e)	Add overhead and profit for any and all tiers of Subcontractor , the total not to exceed ten percent (10%) of Item (d)		
(f)	Subtotal		
(g)	Add Overhead and Profit for Contractor , not to exceed five percent (5%) of Item (f)		
(h)	Subtotal		
(i)	Add Bond and Insurance , not to exceed one and a half percent (1.5%) of Item (h)		
(j)	TOTAL		
(k)	Time (zero unless indicated; "TBD" not permitted)		Calendar Days

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(MLH)/Project No. 2463	Peralta Community College District
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	WORK PERFORMED BY CONTRACTOR	ADD	DEDUCT
(a)	Material (attach itemized quantity and unit cost plus sales tax)		
(b)	Add Labor (attach itemized hours and rates, fully encumbered)		
(c)	Add Equipment (attach suppliers' invoice)		
(d)	Subtotal		
(e)	Add Overhead and Profit for Contractor , not to exceed fifteen percent (15%) of Item (d)		
(f)	Subtotal		
(g)	Add Bond and Insurance , not to exceed one and a half percent (1.5%) of Item (f)		
(h)	TOTAL		
(i)	Time (zero unless indicated; "TBD" not permitted)	Calendar Days	

The undersigned Contractor approves the foregoing as to the changes, if any, to the Contract Price specified for each item, and as to the extension of time allowed, if any, for completion of the entire Work as stated herein, and agrees to furnish all labor, materials, and service, and perform all work necessary to complete any additional work specified for the consideration stated herein. Submission of sums which have no basis in fact or which Contractor knows are false are at the sole risk of Contractor and may be a violation of the False Claims Act set forth under Government Code section 12650 et seq. It is understood that the changes herein to the Contract shall only be effective when approved by the governing board of the District.

It is expressly understood that the value of the extra Work or changes expressly includes any and all of the Contractor's costs and expenses, direct and indirect, resulting from additional time required on the Project or resulting from delay to the Project including, without limitation, cumulative impacts. Contractor is not entitled to separately recover amounts for overhead or other indirect costs. Any costs, expenses, damages, or time extensions not included are deemed waived.

SUBMITTED BY:

Contractor:

[Name]

Date

END OF SECTION

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Issue for Bid		Proposed Change Order Form

(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
N&T 22003	Oakland, California

SECTION 00 63 63 - CHANGE ORDER FORM

Peralta Community College District
333 East 8th Street
Oakland, CA 94606

CHANGE ORDER NO.:

CHANGE ORDER

Project:
Bid No.:

Date:
DSA File No.:
DSA Appl. No.:

The following parties agree to the terms of this Change Order:

Owner:

[Name / Address]

Contractor:

[Name / Address]

Architect:

[Name / Address]

Project Inspector:

[Name / Address]

Reference	Description	Cost	Days Ext.
PCO # Requested by: Performed by: Reason:	[Description of change] [Requester] [Performer] [Reason]	\$	
PCO # Requested by: Performed by: Reason:	[Description of change] [Requester] [Performer] [Reason]	\$	
PCO # Requested by: Performed by: Reason:	[Description of change] [Requester] [Performer] [Reason]	\$	
Contract time will be adjusted as follows:		Original Contract Amount:	\$
Previous Completion Date: <u> [Date] </u>		Amount of Previously Approved Change Order(s):	\$
<u> [#] </u> Calendar Days Extension (zero unless otherwise indicated)		Amount of this Change Order:	\$
Current Completion Date: <u> [Date] </u>		Contract Amount:	\$

(MLH)/Project No. 2463	Peralta Community College District
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The undersigned Contractor approves the foregoing as to the changes, if any, to the Contract Price specified for each item, and as to the extension of time allowed, if any, for completion of the entire work as stated therein, and agrees to furnish all labor, materials and services and perform all work necessary to complete any additional work specified for the consideration stated therein. Submission of sums which have no basis in fact or which Contractor knows are false are at the sole risk of Contractor and may be a violation of the False Claims Act set forth under Government Code section 12650 et seq.

This change order is subject to approval by the governing board of this District and must be signed by the District. Until such time as this change order is approved by the District's governing board and executed by a duly authorized District representative, this change order is not effective and not binding.

It is expressly understood that the compensation and time, if any, granted herein represent a full accord and satisfaction for any and all time and cost impacts of the items herein, and Contractor waives any and all further compensation or time extension based on the items herein. The value of the extra work or changes expressly includes any and all of the Contractor's costs and expenses, and its subcontractors, both direct and indirect, resulting from additional time required on the project or resulting from delay to the project including without limitation, cumulative impacts. Any costs, expenses, damages or time extensions not included are deemed waived.

Signatures:

District:

Contractor:

[Name] Date

[Name] Date

Architect:

Project Inspector:

[Name] Date

[Name] Date

END OF SECTION

(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
N&T 22003	Oakland, California

SECTION 00 65 19.26 - AGREEMENT AND RELEASE OF ANY AND ALL CLAIMS GUARANTEE FORM

THIS AGREEMENT AND RELEASE OF CLAIMS ("Agreement and Release") IS MADE AND ENTERED INTO THIS _____ DAY OF _____, 20____ by and between the PERALTA COMMUNITY COLLEGE DISTRICT ("District") and _____ ("Contractor"), whose place of business is _____.

RECITALS

WHEREAS, District and Contractor entered into MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX/CONTRACT NO.: _____ ("Contract" or "Project") in the County of Alameda, California; and

WHEREAS, the Work under the Contract was completed on _____, and a Notice of Completion was recorded with the County Recorder on _____.

NOW, THEREFORE, it is mutually agreed between District and Contractor as follows:

AGREEMENT AND RELEASE

1. Contractor will only be assessed liquidated damages as detailed below:

Original Contract Sum \$ _____

Modified Contract Sum \$ _____

Payment to Date \$ _____

Liquidated Damages \$ _____

Payment Due Contractor \$ _____

2. Subject to the provisions hereof, District shall forthwith pay to Contractor the undisputed sum of _____ Dollars (\$ _____) under the Contract, less any amounts represented by any notice to withhold funds on file with District as of the date of such payment.
3. Contractor acknowledges and hereby agrees that there are no unresolved or outstanding claims in dispute against District arising from the performance of work under the Contract, except for the claims described in Paragraph 6 and continuing obligations described in Paragraph 8. It is the intention of the parties in executing this Agreement and Release that this Agreement and Release shall be effective as a full, final and general release of all claims, demands, actions, causes of action, obligations, costs, expenses, damages, losses and liabilities of Contractor against District and all of its respective agents, employees, trustees, inspectors, assignees, consultants and transferees, except for any Disputed Claim that may be set forth in Paragraph 4 and the continuing obligations described in Paragraph 6 hereof.

December 3, 2021	1	00 65 19.26
Issue for Bid		Agreement and Release of Any and All Claims Guarantee Form

(MLH)/Project No. 2463	Peralta Community College District
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N&T 22003	Oakland, California

4. The following claims are disputed (hereinafter, the "Disputed Claims") and are specifically excluded from the operation of this Agreement and Release:

<u>Claim No.</u>	<u>Description of Claim</u>	<u>Amount of Claim</u>	<u>Date Claim Submitted</u>
_____	_____	\$ _____	_____
_____	_____	\$ _____	_____
_____	_____	\$ _____	_____
_____	_____	\$ _____	_____

[If further space is required, attach additional sheets showing the required information.]

5. Consistent with California Public Contract Code section 7100, Contractor hereby agrees that, in consideration of the payment set forth in Paragraph 4 hereof, Contractor hereby releases and forever discharges District, all its agents, employees, inspectors, assignees, and transferees from any and all liability, claims, demands, actions, or causes of action of whatever kind or nature arising out of or in any way concerned with the Work under the Contract.
6. Guarantees and warranties for the Work, and any other continuing obligation of Contractor, including without limitation the duty to defend, indemnify and hold harmless the District, shall remain in full force and effect as specified in the Contract Documents.
7. Contractor hereby waives the provisions of California Civil Code section 1542 which provides as follows:
- A GENERAL RELEASE DOES NOT EXTEND TO CLAIMS THAT THE CREDITOR OR RELEASING PARTY DOES NOT KNOW OR SUSPECT TO EXIST IN HIS OR HER FAVOR AT THE TIME OF EXECUTING THE RELEASE, AND THAT, IF KNOWN BY HIM OR HER WOULD HAVE MATERIALLY AFFECTED HIS OR HER SETTLEMENT WITH THE DEBTOR OR RELEASED PARTY.
8. The provisions of this Agreement and Release are contractual in nature and not mere recitals and shall be considered independent and severable. If any such provision or any part thereof shall be at any time held invalid in whole or in part under any federal, state, county, municipal, or other law, ruling, or regulations, then such provision, or part thereof, shall remain in force and effect to the extent permitted by law, and the remaining provisions of this Agreement and Release shall also remain in full force and effect, and shall be enforceable.

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Issue for Bid		Agreement and Release of Any and All Claims Guarantee Form

(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
N&T 22003	Oakland, California

9. All rights of District shall survive completion of the Work or termination of Contract, and execution of this Release.

* * * CAUTION: THIS IS A RELEASE - READ BEFORE EXECUTING * * *

PERALTA COMMUNITY COLLEGE DISTRICT

Signature: _____

Print Name: _____

Title: _____

CONTRACTOR: _____

Signature: _____

Print Name: _____

Title: _____

END OF SECTION

December 3, 2021	3	00 65 19.26
Issue for Bid		Agreement and Release of Any and All Claims Guarantee Form

(MLH)/Project No. 2463	Peralta Community College District
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Issue for Bid		Agreement and Release of Any and All Claims Guarantee Form

(MLH)/Project No. 2463	Peralta Community College District
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N&T 22003	Oakland, California

SECTION 00 65 36 - GUARANTEE FORM

_____ ("Contractor") hereby agrees that the (_____
 _____ "Work" of Contractor) which Contractor has installed for the Peralta Community College District
 ("District") for the following project:

PROJECT: MERRITT COLLEGE NEW LANDSCAPE HORTICULTURE COMPLEX (MLH)

("Project" or "Contract") has been performed in accordance with the requirements of the Contract Documents and that the Work as installed will fulfill the requirements of the Contract Documents.

The undersigned agrees to repair or replace any or all of such Work that may prove to be defective in workmanship or material together with any other adjacent Work that may be displaced in connection with such replacement within a period of two year(s) from the date of completion as defined in Public Contract Code section 7107, subdivision (c), ordinary wear and tear and unusual abuse or neglect excepted. The date of completion is _____, 20__.

In the event of the undersigned's failure to comply with the above-mentioned conditions within a reasonable period of time, as determined by the District, but not later than seven (7) days after being notified in writing by the District, the undersigned authorizes the District to proceed to have said defects repaired and made good at the expense of the undersigned. The undersigned shall pay the costs and charges therefor upon demand.

Date: _____

Proper Name of Contractor: _____

Signature: _____

Print Name: _____

Title: _____

Representatives to be contacted for service subject to terms of Contract:

Name: _____

Address: _____

Phone No.: _____

Email: _____

END OF SECTION

December 3, 2021	1	00 65 36
Issue for Bid		Guarantee Form

(MLH)/Project No. 2463	Peralta Community College District
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N&T 22003	Oakland, California

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December 3, 2021	2	00 65 36
Issue for Bid		Guarantee Form

(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
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SECTION 00 72 13 – GENERAL CONDITIONS – STIPULATED SUM (SINGLE-PRIME CONTRACT)

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DOCUMENT 00 72 13

GENERAL CONDITIONS

1. CONTRACT TERMS AND DEFINITIONS

1.1 Definitions

Wherever used in the Contract Documents, the following terms shall have the meanings indicated, which shall be applicable to both the singular and plural thereof:

1.1.1 Adverse Weather: Shall be only weather that satisfies all of the following conditions: (1) unusually severe precipitation, sleet, snow, hail, or extreme temperature conditions in excess of the norm for the location and time of year it occurred based on the closest weather station data averaged over the past five years, (2) that is unanticipated and would cause unsafe work conditions and/or is unsuitable for scheduled work that should not be performed during inclement weather (i.e., exterior finishes), and (3) at the Project.

1.1.2 Allowance Expenditure Directive: Written authorization for expenditure of allowance, if any.

1.1.3 Approval, Approved, and/or Accepted: Written authorization, unless stated otherwise.

1.1.4 Architect (or “Design Professional in General Responsible Charge”): The individual, partnership, corporation, joint venture, or any combination thereof, named as Architect, who will have the rights and authority assigned to the Architect in the Contract Documents. The term Architect means the Design Professional in General Responsible Charge as defined in DSA PR 13-02 on this Project or the Architect’s authorized representative.

1.1.5 As-Builts: Electronic files (CADD and PDF) of drawings to be prepared on a monthly basis pursuant to the Contract Documents, that reflect changes made during the performance of the Work, recording differences between the original design of the Work and the Work as constructed since the preceding monthly submittal. See **Record Drawings**.

1.1.6 Bidder: A contractor who intends to provide a proposal to the District to perform the Work of this Contract.

1.1.7 Change Order: A written order to the Contractor authorizing an addition to, deletion from, or revision in the Work, and/or authorizing an adjustment in the Contract Price or Contract Time.

1.1.8 Claim: A Dispute that remains unresolved at the conclusion of the all the applicable Dispute Resolution requirements provided herein.

1.1.9 Construction Change Directive: A written order prepared and issued by the District, the Construction Manager, and/or the Architect and signed by the District and the Architect, directing a change in the Work.

1.1.10 Construction Manager: The individual, partnership, corporation, joint venture, or any combination thereof, or its authorized representative, named as such by the District. If no

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Construction Manager is used on the Project that is the subject of this Contract, then all references to Construction Manager herein shall be read to refer to District.

1.1.11 Construction Schedule: The progress schedule of construction of the Project as provided by Contractor and approved by District.

1.1.12 Contract, Contract Documents: The Contract consists exclusively of the documents evidencing the agreement of the District and Contractor, identified as the Contract Documents. The Contract Documents consist of the following documents:

- 1.1.12.1** Notice to Bidders
- 1.1.12.2** Instructions to Bidders
- 1.1.12.3** Bid Form and Proposal
- 1.1.12.4** Bid Bond
- 1.1.12.5** Designated Subcontractors List
- 1.1.12.6** Site Visit Certification (if a site visit was required)
- 1.1.12.7** Non-Collusion Declaration
- 1.1.12.8** Notice of Award
- 1.1.12.9** Notice to Proceed
- 1.1.12.10** Agreement
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- 1.1.12.23** Hazardous Materials Certification (if applicable)
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- 1.1.12.25** Imported Materials Certification (if applicable)
- 1.1.12.26** Sex Offender Registration Act Certification (if applicable)
- 1.1.12.27** Buy American Certification (if applicable)
- 1.1.12.28** Roofing Project Certification (if applicable)
- 1.1.12.29** Registered Subcontractors List
- 1.1.12.30** Iran Contracting Act Certification (if applicable)
- 1.1.12.31** Post Bid Interview
- 1.1.12.32** All Plans, Technical Specifications, and Drawings
- 1.1.12.33** Any and all addenda to any of the above documents
- 1.1.12.34** Any and all change orders or written modifications to the above documents if approved in writing by the District

1.1.13 Contract Price: The total monies payable to the Contractor under the terms and conditions of the Contract Documents.

1.1.14 Contract Time: The time period stated in the Agreement for the completion of the Work.

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Issue for Bid		General Conditions – Stipulated Sum (Single-Prime Contract)

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1.1.15 Contractor: The person or persons identified in the Agreement as contracting to perform the Work to be done under this Contract, or the legal representative of such a person or persons.

1.1.16 Daily Job Report(s): Daily Project reports prepared by the Contractor's employee(s) who are present on Site, which shall include the information required herein.

1.1.17 Day(s): Unless otherwise designated, day(s) means calendar day(s).

1.1.18 Department of Industrial Relations (or "DIR"): is responsible, among other things, for labor compliance monitoring and enforcement of California prevailing wage laws and regulations for public works contracts.

1.1.19 Design Professional in General Responsible Charge: See definition of **Architect** above.

1.1.20 Dispute: A separate demand by Contractor for a time extension, or payment of money or damages arising from Work done by or on behalf of the Contractor pursuant to the Contract and payment of which is not otherwise expressly provided for or Contractor is not otherwise entitled to; or an amount of payment disputed by the District.

1.1.21 District: The public agency or the district for which the Work is performed. The governing board of the District or its designees will act for the District in all matters pertaining to the Contract. The District may, at any time,

1.1.21.1 Direct the Contractor to communicate with or provide notice to the Construction Manager or the Architect on matters for which the Contract Documents indicate the Contractor will communicate with or provide notice to the District; and/or

1.1.21.2 Direct the Construction Manager or the Architect to communicate with or direct the Contractor on matters for which the Contract Documents indicate the District will communicate with or direct the Contractor.

1.1.22 Drawings (or "Plans"): The graphic and pictorial portions of the Contract Documents showing the design, location, scope and dimensions of the work, generally including plans, elevations, sections, details, schedules, sequence of operation, and diagrams.

1.1.23 DSA: Division of the State Architect.

1.1.24 Force Account Directive: A process that may be used when the District and the Contractor cannot agree on a price for a specific portion of work or before the Contractor prepares a price for a specific portion of work and whereby the Contractor performs the work as indicated herein on a time and materials basis.

1.1.25 Job Cost Reports: Any and all reports or records detailing the costs associated with work performed on or related to the Project that Contractor shall maintain for the Project. Specifically, Job Cost Reports shall contain, but are not limited by or to, the following information: a description of the work performed or to be performed on the Project; quantity, if applicable, of work performed (hours, square feet, cubic yards, pounds, etc.) for the Project; Project budget; costs for the Project to date; estimated costs to complete the Project; and expected costs at completion. The Job Cost Reports shall also reflect all Contract cost codes, change orders, elements of non-conforming work, back charges, and additional services.

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Issue for Bid		General Conditions – Stipulated Sum (Single-Prime Contract)

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1.1.26 Labor Commissioner's Office (or "Labor Commissioner", also known as the Division of Labor Standards Enforcement ("DLSE")): Division of the DIR responsible for adjudicating wage claims, investigating discrimination and public works complaints, and enforcing Labor Code statutes and Industrial Welfare Commission orders.

1.1.27 Municipal Separate Storm Sewer System (or "MS4"): A system of conveyances used to collect and/or convey storm water, including, without limitation, catch basins, curbs, gutters, ditches, man-made channels, and storm drains.

1.1.28 Plans: See **Drawings**.

1.1.29 Premises: The real property owned by the District on which the Site is located.

1.1.30 Product(s): New material, machinery, components, equipment, fixtures and systems forming the Work, including existing materials or components required and approved by the District for reuse.

1.1.31 Product Data: Illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate a material, product, or system for some portion of the Work.

1.1.32 Program Manager: The individual, partnership, corporation, joint venture, or any combination thereof, or its authorized representative, named as such by the District. If no Program Manager is designated for Project that is the subject of this Contract, then all references to Project Manager herein shall be read to refer to District.

1.1.33 Project: The planned undertaking as provided for in the Contract Documents.

1.1.34 Project Inspector (or "Inspector"): The individual(s) retained by the District in accordance with title 24 of the California Code of Regulations to monitor and inspect the Project.

1.1.35 Project Labor Agreement (or "PLA"): a prehire collective bargaining agreement in accordance with Public Contract Code section 2500 *et seq.* that establishes terms and conditions of employment for a specific construction project or projects and/or is an agreement described in Section 158(f) of Title 29 of the United States Code.

1.1.36 Proposed Change Order (or "PCO"): a written request prepared by the Contractor requesting that the District and the Architect issue a Change Order based upon a proposed change to the Work.

1.1.37 Provide: Shall include "provide complete in place," that is, "furnish and install," and "provide complete and functioning as intended in place" unless specifically stated otherwise.

1.1.38 Qualified SWPPP Practitioners (or "QSP"): certified personnel that attended a State Water Resources Control Board sponsored or approved training class and passed the qualifying exam.

1.1.39 Record Drawings: Reproducible (Electronic files) drawings (or Plans) prepared pursuant to the requirements of the Contract Documents that reflect all changes made during the performance of the Work, recording differences between the original design of the Work and the Work as constructed upon completion of the Project. See also **As-Built**s.

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1.1.40 Request for Information (or “RFI”): A written request prepared by the Contractor requesting that the Architect provide additional information necessary to clarify or amplify an item in the Contract Documents that the Contractor believes is not clearly shown or called for in the Drawings or Specifications or other portions of the Contract Documents, or to address problems that have arisen under field conditions.

1.1.41 Request for Substitution for Specified Item: A request by Contractor to substitute an equal or superior material, product, thing, or service for a specific material, product, thing, or service that has been designated in the Contract Documents by a specific brand or trade name.

1.1.42 Safety Orders: Written and/or verbal orders for construction issued by the California Division of Occupational Safety and Health (“CalOSHA”) or by the United States Occupational Safety and Health Administration (“OSHA”).

1.1.43 Safety Plan: Contractor’s safety plan specifically adapted for the Project. Contractor’s Safety Plan shall comply with all provisions regarding Project safety, including all applicable provisions in these General Conditions.

1.1.44 Samples: Physical examples that illustrate materials, products, equipment, finishes, colors, or workmanship and that, when approved in accordance with the Contract Documents, establish standards by which portions of the Work will be judged.

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1.1.45 Shop Drawings: All drawings, prints, diagrams, illustrations, brochures, schedules, and other data that are prepared by the Contractor, a subcontractor, manufacturer, supplier, or distributor, that illustrate how specific portions of the Work shall be fabricated or installed.

1.1.46 Site: The Project site as shown on the Drawings.

1.1.47 Specifications: That portion of the Contract Documents, Division 1 through Division 49, and all technical sections, and addenda to all of these, if any, consisting of written descriptions and requirements of a technical nature of materials, equipment, construction methods and systems, standards, and workmanship.

1.1.48 State: The State of California.

1.1.49 Storm Water Pollution Prevention Plan (or "SWPPP"): A document which identifies sources and activities at a particular facility that may contribute pollutants to storm water and contains specific control measures and time frames to prevent or treat such pollutants.

1.1.50 Subcontractor: A contractor and/or supplier who is under contract with the Contractor or with any other subcontractor, regardless of tier, to perform a portion of the Work of the Project.

1.1.51 Submittal Schedule: The schedule of submittals as provided by Contractor and approved by District.

1.1.52 Surety: The person, firm, or corporation that executes as surety the Contractor's Performance Bond and Payment Bond, and must be a California admitted surety insurer as defined in the Code of Civil Procedure section 995.120.

1.1.53 Work: All labor, materials, equipment, components, appliances, supervision, coordination, and services required by, or reasonably inferred from, the Contract Documents, that are necessary for the construction and completion of the Project.

1.2 Laws Concerning the Contract

Contract is subject to all provisions of the Constitution and laws of California and the United States governing, controlling, or affecting District, or the property, funds, operations, or powers of District, and such provisions are by this reference made a part hereof. Any provision required by law to be included in this Contract shall be deemed to be inserted.

1.3 No Oral Agreements

No oral agreement or conversation with any officer, agent, or employee of District, either before or after execution of Contract, shall affect or modify any of the terms or obligations contained in any of the documents comprising the Contract.

1.4 No Assignment

Contractor shall not assign this Contract or any part thereof including, without limitation, any Work or money to become due hereunder without the prior written consent of the District. Assignment without District's prior written consent shall be null and void. Any assignment of money due or to become due under this Contract shall be subject to a prior lien for services rendered or material supplied for performance of work called for under this Contract in favor of all persons, firms, or corporations rendering services or supplying material to the extent that claims are filed pursuant to the Civil Code,

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Code of Civil Procedure, Government Code, Labor Code, and/or Public Contract Code, and shall also be subject to deductions for liquidated damages or withholding of payments as determined by District in accordance with this Contract. Contractor shall not assign or transfer in any manner to a Subcontractor or supplier the right to prosecute or maintain an action against the District.

1.5 Notice and Service Thereof

1.5.1 Any notice from one party to the other or otherwise under Contract shall be in writing and shall be dated and signed by the party giving notice or by a duly authorized representative of that party. Any notice shall not be effective for any purpose whatsoever unless served in one of the following manners:

1.5.1.1 If notice is given by personal delivery thereof, it shall be considered delivered on the day of delivery.

1.5.1.2 If notice is given by overnight delivery service, it shall be considered delivered one (1) day after date deposited, as indicated by the delivery service.

1.5.1.3 If notice is given by depositing same in United States mail, enclosed in a sealed envelope, it shall be considered delivered three (3) days after date deposited, as indicated by the postmarked date.

1.5.1.4 If notice is given by registered or certified mail with postage prepaid, return receipt requested, it shall be considered delivered on the day the notice is signed for.

1.5.1.5 Electronic mail may be used for convenience but is not a substitute for the notice and service requirements herein.

1.6 No Waiver

The failure of District in any one or more instances to insist upon strict performance of any of the terms of this Contract or to exercise any option herein conferred shall not be construed as a waiver or relinquishment to any extent of the right to assert or rely upon any such terms or option on any future occasion. No action or failure to act by the District, Architect, or Construction Manager shall constitute a waiver of any right or duty afforded the District under the Contract, nor shall any action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

1.7 Substitutions for Specified Items

1.7.1 Whenever in the Specifications any materials, process, or article is indicated or specified by grade, patent, or proprietary name, or by name of manufacturer, that Specification shall be deemed to be followed by the words "or equal." Contractor may, unless otherwise stated, offer any material, process, or article that shall be substantially equal or better in every respect to that so indicated or specified.

1.7.1.1 If the material, process, or article offered by Contractor is not, in the opinion of the District, substantially equal or better in every respect to that specified, then Contractor shall furnish the material, process, or article specified in the Specifications without any additional compensation or change order.

1.7.1.2 This provision shall not be applicable with respect to any material, product, thing or service for which District made findings and gave notice in accordance with Public

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Contract Code section 3400(c); therefore, Contractor shall not be entitled to request a substitution with respect to those materials, products or services.

1.7.2 A request for a substitution shall be submitted as follows:

1.7.2.1 Contractor shall notify the District in writing of any request for a substitution at least ten (10) days prior to bid opening as indicated in the Instructions to Bidders.

1.7.2.2 Requests for Substitutions after award of the Contract shall be submitted within thirty-five (35) days of the date of the Notice of Award.

1.7.3 Within 35 days after the date of the Notice of Award, Contractor shall provide data substantiating a request for substitution of "an equal" item, including but not limited to the following:

1.7.3.1 All variations of the proposed substitute from the material specified including, but not limited to, principles of operation, materials, or construction finish, thickness or gauge of materials, dimensions, weight, and tolerances;

1.7.3.2 Available maintenance, repair or replacement services;

1.7.3.3 Increases or decreases in operating, maintenance, repair, replacement, and spare parts costs;

1.7.3.4 Whether or not acceptance of the substitute will require other changes in the Work (or in work performed by the District or others under Contract with the District); and

1.7.3.5 The time impact on any part of the Work resulting directly or indirectly from acceptance of the proposed substitute.

1.7.4 No substitutions shall be made until approved, in writing, by the District. The burden of proof as to equality of any material, process, or article shall rest with Contractor. The Contractor warrants that if substitutes are approved:

1.7.4.1 The proposed substitute is equal or superior in all respects to that specified, and that such proposed substitute is suitable and fit for the intended purpose and will perform adequately the function and achieve the results called for by the general design and the Contract Documents;

1.7.4.2 The Contractor provides the same warranties and guarantees for the substitute that would be provided for that specified;

1.7.4.3 The Contractor shall be fully responsible for the installation of the substitute and any changes in the Work required, either directly or indirectly, because of the acceptance of such substitute, with no increase in Contract Price or Contract Time. Incidental changes or extra component parts required to accommodate the substitute will be made by the Contractor without a change in the Contract Price or Contract Time;

1.7.4.4 The Contractor shall be responsible for any re-design costs occasioned by District's acceptance and/or approval of any substitute; and

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1.7.4.5 The Contractor shall, in the event that a substitute is less costly than that specified, credit the District with one hundred percent (100%) of the net difference between the substitute and the originally specified material. In this event, the Contractor agrees to execute a deductive Change Order to reflect that credit.

1.7.5 In the event Contractor furnishes a material, process, or article more expensive than that specified, the difference in the cost of that material, process, or article so furnished shall be borne by Contractor.

1.7.6 In no event shall the District be liable for any increase in Contract Price or Contract Time due to any claimed delay in the evaluation of any proposed substitute or in the acceptance or rejection of any proposed substitute.

1.7.7 Contractor shall be responsible for any costs the District incurs for professional services, DSA fees, or delay to the Project Schedule, if applicable, while DSA reviews changes for the convenience of Contractor and/or to accommodate Contractor's means and methods. District may deduct those costs from any amounts owing to the Contractor for the review of the request for substitution, even if the request for substitution is not approved. District, at its sole discretion, shall deduct from the payments due to and/or invoice Contractor for all the professional services and/or DSA fees or delay to the Project Schedule, if applicable, while DSA reviews changes for the convenience of Contractor and/or to accommodate Contractor's means and methods arising herein.

1.8 Materials and Work

1.8.1 Except as otherwise specifically stated in this Contract, Contractor shall provide and pay for all materials, labor, tools, equipment, transportation, supervision, temporary constructions of every nature, and all other services, management, and facilities of every nature whatsoever necessary to execute and complete this Contract, in a good and workmanlike manner, within the Contract Time.

1.8.2 Unless otherwise specified, all materials shall be new and of the best quality of their respective kinds and grades as noted or specified, workmanship shall be of good quality, and Contractor shall use all diligence to inform itself fully as to the required manufacturer's instructions and to comply therewith.

1.8.3 Materials shall be furnished in ample quantities and at such times as to ensure uninterrupted progress of Work and shall be stored properly and protected from the elements, theft, vandalism, or other loss or damage as required.

1.8.4 For all materials and equipment specified or indicated in the Drawings, the Contractor shall provide all labor, materials, equipment, and services necessary for complete assemblies and complete working systems, functioning as intended. Incidental items not indicated on Drawings, nor mentioned in the Specifications, that can legitimately and reasonably be inferred to belong to the Work described, or be necessary in good practice to provide a complete assembly or system, shall be furnished as though itemized here in every detail. In all instances, material and equipment shall be installed in strict accordance with each manufacturer's most recent published recommendations and specifications.

1.8.5 Contractor shall, after award of Contract by District and after relevant submittals have been approved, place orders for materials and/or equipment as specified so that delivery of same may be made without delays to the Work. Contractor shall, upon five (5) days' demand from District, present documentary evidence showing that orders have been placed.

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1.8.6 District reserves the right but has no obligation, in response to Contractor's neglect or failure in complying with the above instructions, to place orders for such materials and/or equipment as the District may deem advisable in order that the Work may be completed at the date specified in the Contract, and all expenses incidental to the procuring of said materials and/or equipment shall be paid for by Contractor or deducted from payment(s) to Contractor.

1.8.7 Contractor warrants good title to all material, supplies, and equipment installed or incorporated in Work and agrees upon completion of all Work to deliver the Site to District, together with all improvements and appurtenances constructed or placed thereon by it, and free from any claims, liens, or charges. Contractor further agrees that neither it nor any person, firm, or corporation furnishing any materials or labor for any work covered by the Contract shall have any right to lien any portion of the Premises or any improvement or appurtenance thereon, except that Contractor may install metering devices or other equipment of utility companies or of political subdivision, title to which is commonly retained by utility company or political subdivision. In the event of installation of any such metering device or equipment, Contractor shall advise District as to owner thereof.

1.8.7.1 If a lien or a claim based on a stop payment notice of any nature should at any time be filed against the Work or any District property, by any entity that has supplied material or services at the request of the Contractor, Contractor and Contractor's Surety shall promptly, on demand by District and at Contractor's and Surety's own expense, take any and all action necessary to cause any such lien or a claim based on a stop payment notice to be released or discharged immediately therefrom.

1.8.7.2 If the Contractor fails to furnish to the District within ten (10) calendar days after demand by the District, satisfactory evidence that a lien or a claim based on a stop payment notice has been so released, discharged, or secured, the District may discharge such indebtedness and deduct the amount required therefor, together with any and all losses, costs, damages, and attorney's fees and expense incurred or suffered by District from any sum payable to Contractor under the Contract.

1.8.8 Nothing contained in this Article, however, shall defeat or impair the rights of persons furnishing materials or labor under any bond given by Contractor for their protection or any rights under any law permitting such protection or any rights under any law permitting such persons to look to funds due Contractor in hands of District (e.g., stop payment notices), and this provision shall be inserted in all subcontracts and material contracts and notice of its provisions shall be given to all persons furnishing material for work when no formal contract is entered into for such material.

1.8.9 Title to new materials and/or equipment for the Work of this Contract and attendant liability for its protection and safety shall remain with Contractor until incorporated in the Work of this Contract and accepted by District. No part of any materials and/or equipment shall be removed from its place of storage except for immediate installation in the Work of this Contract. Should the District, in its discretion, allow the Contractor to store materials and/or equipment for the Work off-site, Contractor will store said materials and/or equipment at a bonded warehouse and with appropriate insurance coverage at no cost to District. Contractor shall keep an accurate inventory of all materials and/or equipment in a manner satisfactory to District or its authorized representative and shall, at the District's request, forward it to the District.

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2. [RESERVED]

3. ARCHITECT

3.1 The Architect shall represent the District during the Project and will observe the progress and quality of the Work on behalf of the District. Architect shall have the authority to act on behalf of District to the extent expressly provided in the Contract Documents and to the extent determined by District. Architect shall have authority to reject materials, workmanship, and/or the Work whenever rejection may be necessary, in Architect's reasonable opinion, to ensure the proper execution of the Contract.

3.2 Architect shall, with the District and on behalf of the District, determine the amount, quality, acceptability, and fitness of all parts of the Work, and interpret the Specifications, Drawings, and shall, with the District, interpret all other Contract Documents.

3.3 Architect shall have all authority and responsibility established by law, including title 24 of the California Code of Regulations.

3.4 Contractor shall provide District and the Construction Manager with a copy of all written communication between Contractor and Architect at the same time as that communication is made to Architect, including, without limitation, all RFIs, correspondence, submittals, claims, and proposed change orders.

4. CONSTRUCTION MANAGER

4.1 If a Construction Manager is used on this Project ("Construction Manager" or "CM"), the Construction Manager will provide administration of the Contract on the District's behalf. After execution of the Contract and Notice to Proceed, all correspondence and/or instructions from Contractor and/or District shall be forwarded through the Construction Manager. The Construction Manager will not be responsible for and will not have control or charge of construction means, methods, techniques, sequences, or procedures or for safety precautions in connection with the Work, which shall all remain the Contractor's responsibility.

4.2 The Construction Manager, however, will have authority to reject materials and/or workmanship not conforming to the Contract Documents, as determined by the District, the Architect, and/or the Project Inspector. The Construction Manager shall also have the authority to require special inspection or testing of any portion of the Work, whether it has been fabricated, installed, or fully completed. Any decision made by the Construction Manager, in good faith, shall not give rise to any duty or responsibility of the Construction Manager to: the Contractor; any Subcontractor; the Contractor or Subcontractor's respective agents, employees; or other persons performing any of the Work. The Construction Manager shall have free access to any or all parts of Work at any time.

4.3 If the District does not use a Construction Manager on this Project, all references within the Contract Documents to Construction Manager or CM shall be read as District.

5. INSPECTOR, INSPECTIONS, AND TESTS

5.1 Project Inspector

5.1.1 One or more Project Inspector(s), including special Project Inspector(s), as required, will be assigned to the Work by District, in accordance with requirements of title 24, part 1, of the California Code of Regulations, to enforce the building code and monitor compliance with Plans

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and Specifications for the Project previously approved by the DSA. Duties of Project Inspector(s) are specifically defined in section 4-342 of said part 1 of title 24.

5.1.2 No Work shall be carried on except with the knowledge and under the inspection of the Project Inspector(s). The Project Inspector(s) shall have free access to any or all parts of Work at any time. Contractor shall furnish Project Inspector(s) reasonable opportunities for obtaining such information as may be necessary to keep Project Inspector(s) fully informed respecting progress and manner of work and character of materials, including, but not limited to, submission of form DSA 156 (or the most current version applicable at the time the Work is performed) to the Project Inspector at least 48 hours in advance of the commencement and completion of construction of each and every aspect of the Work. Forms are available on the DSA's website at: <http://www.dgs.ca.gov/dsa/Forms.aspx>. Inspection of Work shall not relieve Contractor from an obligation to fulfill this Contract. Project Inspector(s) and the DSA are authorized to suspend work whenever the Contractor and/or its Subcontractor(s) are not complying with the Contract Documents. Any work stoppage by the Project Inspector(s) and/or DSA shall be without liability to the District. Contractor shall instruct its Subcontractors and employees accordingly.

5.1.3 If Contractor and/or any Subcontractor requests that the Project Inspector(s) perform any inspection off-site, this shall only be done if it is allowable pursuant to applicable regulations and DSA approval, if the Project Inspector(s) agree to do so, and at the expense of the Contractor.

5.2 Tests and Inspections

5.2.1 Tests and Inspections shall comply with title 24, part 1, California Code of Regulations, group 1, article 5, section 4-335, and with the provisions of the Specifications.

5.2.2 The District will select an independent testing laboratory to conduct the tests. Selection of the materials required to be tested shall be by the laboratory or the District's representative and not by the Contractor. The Contractor shall notify the District's representative a sufficient time in advance of its readiness for required observation or inspection.

5.2.3 The Contractor shall notify the District's representative a sufficient time in advance of the manufacture of material to be supplied under the Contract Documents, which must by terms of the Contract Documents be tested, in order that the District may arrange for the testing of same at the source of supply. This notice shall be provided, at a minimum, seventy-two (72) hours prior to the manufacture of the material that needs to be tested.

5.2.4 Any material shipped by the Contractor from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said representative that such testing and inspection will not be required, shall not be incorporated into and/or onto the Project.

5.2.5 The District will select the testing laboratory and pay for the costs of all tests and inspections, excepting those inspections performed at Contractor's request and expense. Contractor shall reimburse the District for any and all laboratory costs or other testing costs for any materials found to be not in compliance with the Contract Documents. At the District's discretion, District may elect to deduct laboratory or other testing costs for noncompliant materials from the Contract Price, and such deduction shall not constitute a withholding.

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5.3 Costs for After Hours and/or Off Site Inspections

If the Contractor performs Work outside the Inspector's regular working hours or requests the Inspector to perform inspections off Site, costs of any inspections required outside regular working hours or off Site shall be borne by the Contractor and may be invoiced to the Contractor by the District or the District may deduct those expenses from the next Progress Payment.

6. CONTRACTOR

Contractor shall construct and complete, in a good and workmanlike manner, the Work for the Contract Price including any adjustment(s) to the Contract Price pursuant to provisions herein regarding changes to the Contract Price. Except as otherwise noted, Contractor shall provide and pay for all labor, materials, equipment, permits (excluding DSA), fees, licenses, facilities, transportation, taxes, bonds and insurance, and services necessary for the proper execution and completion of the Work, except as indicated herein.

6.1 Status of Contractor

6.1.1 Contractor is and shall at all times be deemed to be an independent contractor and shall be wholly responsible for the manner in which it and its Subcontractors perform the services required of it by the Contract Documents. Nothing herein contained shall be construed as creating the relationship of employer and employee, or principal and agent, between the District, or any of the District's employees or agents, and Contractor or any of Contractor's Subcontractors, agents or employees. Contractor assumes exclusively the responsibility for the acts of its agents, and employees as they relate to the services to be provided during the course and scope of their employment. Contractor, its Subcontractors, agents, and its employees shall not be entitled to any rights or privileges of District employees. District shall be permitted to monitor the Contractor's activities to determine compliance with the terms of this Contract.

6.1.2 As required by law, Contractor and all Subcontractors shall be properly licensed and regulated by the Contractors State License Board, 9821 Business Park Drive, Sacramento, California 95827, <http://www.cslb.ca.gov>.

6.1.3 As required by law, Contractor and all Subcontractors shall be properly registered as public works contractors by the Department of Industrial Relations at: <https://efiling.dir.ca.gov/PWCR/ActionServlet?action=displayPWCRegistrationForm> or current URL.

6.1.4 Contractor represents that it has no existing interest and will not acquire any interest, direct or indirect, which could conflict in any manner or degree with the performance of the Work required under this Contract and that no person having any such interest shall be employed by Contractor.

6.2 Project Inspection Card(s)

Contractor shall verify that forms DSA 152 (or the current version applicable at the time the Work is performed) are issued for the Project prior to the commencement of construction.

6.3 Contractor's Supervision

6.3.1 During progress of the Work, Contractor shall keep on the Premises, and at all other locations where any Work related to the Contract is being performed, an experienced and competent project manager and construction superintendent who are employees of the

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Contractor, to whom the District does not object and at least one of whom shall be fluent in English, written and verbal.

6.3.2 The project manager and construction superintendent shall both speak fluently the predominant language of the Contractor's employees.

6.3.3 Before commencing the Work herein, Contractor shall give written notice to District of the name of its project manager and construction superintendent. Neither the Contractor's project manager nor construction superintendent shall be changed except with prior written notice to District. If the Contractor's project manager and/or construction superintendent proves to be unsatisfactory to Contractor, or to District, any of the District's employees, agents, the Construction Manager, or the Architect, the unsatisfactory project manager and/or construction superintendent shall be replaced. However, Contractor shall notify District in writing before any change occurs, but no less than two (2) business days prior. Any replacement of the project manager and/or construction superintendent shall be made promptly and must be satisfactory to the District. The Contractor's project manager and construction superintendent shall each represent Contractor, and all directions given to Contractor's project manager and/or construction superintendent shall be as binding as if given to Contractor.

6.3.4 Contractor shall give efficient supervision to Work, using its best skill and attention. Contractor shall carefully study and compare all Contract Documents, Drawings, Specifications, and other instructions and shall at once report to District, Construction Manager, and Architect any error, inconsistency, or omission that Contractor or its employees and Subcontractors may discover, in writing, with a copy to District's Project Inspector(s). The Contractor shall have responsibility for discovery of errors, inconsistencies, or omissions.

6.4 Duty to Provide Fit Workers

6.4.1 Contractor and Subcontractor(s) shall at all times enforce strict discipline and good order among their employees and shall not employ or work any unfit person or anyone not skilled in work assigned to that person. It shall be the responsibility of Contractor to ensure compliance with this requirement. District may require Contractor to permanently remove unfit persons from Project Site.

6.4.2 Any person in the employ of Contractor or Subcontractor(s) whom District may deem incompetent or unfit shall be excluded from working on the Project and shall not again be employed on the Project except with the prior written consent of District.

6.4.3 The Contractor shall furnish labor that can work in harmony with all other elements of labor employed or to be employed in the Work.

6.4.4 If Contractor intends to make any change in the name or legal nature of the Contractor's entity, Contractor must first notify the District in writing prior to making any contemplated change. The District shall determine in writing if Contractor's intended change is permissible while performing this Contract.

6.5 Field Office

6.5.1 Contractor shall provide a temporary office on the Site for the District's use exclusively, during the term of the Contract.

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6.6 Purchase of Materials and Equipment

The Contractor is required to order, obtain, and store materials and equipment sufficiently in advance of its Work at no additional cost or advance payment from District to assure that there will be no delays.

6.7 Documents on Work

6.7.1 Contractor shall at all times keep on the Site, or at another location as the District may authorize in writing, one (1) legible copy of all Contract Documents, including Addenda and Change Orders, and Titles 19 and 24 of the California Code of Regulations, the specified edition(s) of the Uniform Building Code, all approved Drawings, Plans, Schedules, and Specifications, and all codes and documents referred to in the Specifications, and made part thereof. These documents shall be kept in good order and available to District, Construction Manager, Architect, Architect's representatives, the Project Inspector(s), and all authorities having jurisdiction. Contractor shall be acquainted with and comply with the provisions of these titles as they relate to this Project. (See particularly the duties of Contractor, Title 24, Part 1, California Code of Regulations, section 4-343.) Contractor shall also be acquainted with and comply with all California Code of Regulations provisions relating to conditions on this Project, particularly Titles 8 and 17. Contractor shall coordinate with Architect and Construction Manager and shall submit its verified report(s) according to the requirements of Title 24.

6.7.2 Daily Job Reports.

6.7.2.1 Contractor shall maintain, at a minimum, at least one (1) set of Daily Job Reports on the Project. These must be prepared by the Contractor's employee(s) who are present on Site, and must include, at a minimum, the following information:

- 6.7.2.1.1** A brief description of all Work performed on that day.
- 6.7.2.1.2** A summary of all other pertinent events and/or occurrences on that day.
- 6.7.2.1.3** The weather conditions on that day.
- 6.7.2.1.4** A list of all Subcontractor(s) working on that day, including DIR registration numbers.
- 6.7.2.1.5** A list of each Contractor employee working on that day and the total hours worked for each employee.
- 6.7.2.1.6** A complete list of all equipment on Site that day, whether in use or not.
- 6.7.2.1.7** A complete list of all materials, supplies, and equipment delivered on that day.
- 6.7.2.1.8** A complete list of all inspections and tests performed on that day.

6.7.2.2 Each day Contractor shall provide a copy of the previous day's Daily Job Report to the District or the Construction Manager.

6.8 Preservation of Records

Contractor shall maintain, and District shall have the right to inspect, Contractor's financial records for the Project, including, without limitation, Job Cost Reports for the Project in compliance with the criteria set forth herein. The District shall have the right to examine and audit all Daily Job Reports or other Project records of Contractor's project manager(s), project superintendent(s), and/or project foreperson(s), all certified payroll records and/or related documents including, without limitation, Job Cost Reports, payroll, payment, timekeeping and tracking documents; all books, estimates, records, contracts, documents, bid documents, bid cost data, subcontract job cost reports, and other data of the Contractor, any Subcontractor, and/or supplier, including computations and projections related to

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bidding, negotiating, pricing, or performing the Work or Contract modification, in order to evaluate the accuracy, completeness, and currency of the cost, manpower, coordination, supervision, or pricing data at no additional cost to the District. These documents may be duplicative and/or be in addition to any Bid Documents held in escrow by the District. The Contractor shall make available at its office at all reasonable times the materials described in this paragraph for the examination, audit, or reproduction until three (3) years after final payment under this Contract. Notwithstanding the provisions above, Contractor shall provide any records requested by any governmental agency, if available, after the time set forth above.

6.9 Integration of Work

6.9.1 Contractor shall do all cutting, fitting, patching, and preparation of Work as required to make its several parts come together properly, to fit it to receive or be received by work of other contractors, and to coordinate tolerances to various pieces of work, showing upon, or reasonably implied by, the Drawings and Specifications for the completed structure, and shall conform them as District and/or Architect may direct.

6.9.2 Contractor shall make its own layout of lines and elevations and shall be responsible for the accuracy of both Contractor's and Subcontractors' work resulting therefrom.

6.9.3 Contractor and all Subcontractors shall take all field dimensions required in performance of the Work, and shall verify all dimensions and conditions on the Site. All dimensions affecting proper fabrication and installation of all Work must be verified prior to fabrication by taking field measurements of the true conditions. If there are any discrepancies between dimensions in drawings and existing conditions which will affect the Work, Contractor shall bring such discrepancies to the attention of the District and Architect for adjustment before proceeding with the Work. In doing so, it is recognized that Contractor is not acting in the capacity of a licensed design professional, and that Contractor's examination is made in good faith to facilitate construction and does not create an affirmative responsibility of a design professional to detect errors, omissions or inconsistencies in the Contract Documents or to ascertain compliance with applicable laws, building codes or regulations. However, nothing in this provision shall abrogate Contractor's responsibilities for discovering and reporting any error, inconsistency, or omission pursuant to the Contract within the Contractor's standard of care including, without limitation, any applicable laws, ordinance, rules, or regulations. Following receipt of written notice from Contractor, the District and/or Architect shall inform Contractor what action, if any, Contractor shall take with regard to such discrepancies.

6.9.4 All costs caused by noncompliant, defective, or delayed Work shall be borne by Contractor, inclusive of repair work.

6.9.5 Contractor shall not endanger any work performed by it or anyone else by cutting, excavating, or otherwise altering work and shall not cut or alter work of any other contractor except with consent of District.

6.10 Notifications

6.10.1 Contractor shall notify the Architect and Project Inspector, in writing, of the commencement of construction of each and every aspect of the Work at least 48 hours in advance by submitting form DSA 156 (or the most current version applicable at the time the Work is performed) to the Project Inspector. Forms are available on the DSA's website at: <http://www.dgs.ca.gov/dsa/Forms.aspx>.

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6.10.2 Contractor shall notify the Architect and Project Inspector, in writing, of the completion of construction of each and every aspect of the Work at least 48 hours in advance by submitting form DSA 156 (or current version) to the Project Inspector.

6.11 Obtaining of Permits, Licenses and Registrations

Contractor shall secure and pay for all permits (except DSA), licenses, registrations, approvals and certificates necessary for prosecution of Work, including but not limited to those listed in the Special Conditions, if any, before the date of the commencement of the Work or before the permits, licenses, registrations, approvals and certificates are legally required to continue the Work without interruption. The Contractor shall obtain and pay, only when legally required, for all licenses, registrations, approvals, permits, inspections, and inspection certificates required to be obtained from or issued by any authority having jurisdiction over any part of the Work included in the Contract. All final permits, licenses, registrations, approvals and certificates shall be delivered to District before demand is made for final payment.

6.12 Royalties and Patents

6.12.1 Contractor shall obtain and pay, only when legally required, all royalties and license fees necessary for prosecution of Work before the earlier of the date of the commencement of the Work or the date that the license is legally required to continue the Work without interruption. Contractor shall defend suits or claims of infringement of patent, copyright, or other rights and shall hold the District, the Architect, and the Construction Manager harmless and indemnify them from loss on account thereof except when a particular design, process, or make or model of product is required by the Contract Documents. However, if the Contractor has reason to believe that the required design, process, or product is an infringement of a patent or copyright, the Contractor shall indemnify and defend the District, Architect and Construction Manager against any loss or damage unless the Contractor promptly informs the District of its information.

6.12.2 The review by the District or Architect of any method of construction, invention, appliance, process, article, device, or material of any kind shall be only its adequacy for the Work and shall not approve use by the Contractor in violation of any patent or other rights of any person or entity.

6.13 Work to Comply With Applicable Laws and Regulations

6.13.1 Contractor shall give all notices and comply with the following specific laws, ordinances, rules, and regulations and all other applicable laws, ordinances, rules, and regulations bearing on conduct of Work as indicated and specified, including but not limited to the appropriate statutes and administrative code sections. If Contractor observes that Drawings and Specifications are at variance therewith, or should Contractor become aware of the development of conditions not covered by Contract Documents that may result in finished Work being at variance therewith, Contractor shall promptly notify District in writing and any changes deemed necessary by District shall be made as provided in Contract for changes in Work.

6.13.1.1 National Electrical Safety Code, U. S. Department of Commerce

6.13.1.2 National Board of Fire Underwriters' Regulations

6.13.1.3 International Building Code, latest addition, and the California Code of Regulations, title 24, and other amendments

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6.13.1.4 Manual of Accident Prevention in Construction, latest edition, published by A.G.C. of America

6.13.1.5 Industrial Accident Commission's Safety Orders, State of California

6.13.1.6 Regulations of the State Fire Marshall (title 19, California Code of Regulations) and Pertinent Local Fire Safety Codes

6.13.1.7 Americans with Disabilities Act

6.13.1.8 Education Code of the State of California

6.13.1.9 Government Code of the State of California

6.13.1.10 Labor Code of the State of California, division 2, part 7, Public Works and Public Agencies

6.13.1.11 Public Contract Code of the State of California

6.13.1.12 California Art Preservation Act

6.13.1.13 U. S. Copyright Act

6.13.1.14 U. S. Visual Artists Rights Act

6.13.2 Contractor shall comply with all applicable mitigation measures, if any, adopted by any public agency with respect to this Project pursuant to the California Environmental Quality Act (Public Resources Code section 21000 et seq.).

6.13.3 If Contractor performs any Work that it knew, or through exercise of reasonable care should have known, to be contrary to any applicable laws, ordinance, rules, or regulations, Contractor shall bear all costs arising therefrom and arising from the correction of said Work.

6.13.4 Where Specifications or Drawings state that materials, processes, or procedures must be approved by the DSA, State Fire Marshall, or other body or agency, Contractor shall be responsible for satisfying requirements of such bodies or agencies applicable at the time the Work is performed, and as determined by those bodies or agencies.

6.14 Safety/Protection of Persons and Property

6.14.1 The Contractor will be solely and completely responsible for conditions of the Site, including safety of all persons and property during performance of the Work. This requirement will apply continuously and not be limited to normal working hours.

6.14.2 The wearing of hard hats will be mandatory at all times for all personnel on Site. Contractor shall supply sufficient hard hats to properly equip all employees and visitors.

6.14.3 Any construction review of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near the Site.

6.14.4 Implementation and maintenance of safety programs shall be the sole responsibility of the Contractor.

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6.14.5 The Contractor shall furnish to the District a copy of the Contractor's safety plan within the time frame indicated in the Contract Documents and specifically adapted for the Project.

6.14.6 Contractor shall be responsible for all damages to persons or property that occur as a result of its fault or negligence in connection with the prosecution of this Contract and shall take all necessary measures and be responsible for the proper care and completion and final acceptance by District. All Work shall be solely at Contractor's risk with the exception of damage to the Work caused by "acts of God" as defined in Public Contract Code section 7105.

6.14.7 Contractor shall take, and require Subcontractors to take, all necessary precautions for safety of workers on the Project and shall comply with all applicable federal, state, local, and other safety laws, standards, orders, rules, regulations, and building codes to prevent accidents or injury to persons on, about, or adjacent to premises where Work is being performed and to provide a safe and healthful place of employment. Contractor shall furnish, erect, and properly maintain at all times, all necessary safety devices, safeguards, construction canopies, signs, nets, barriers, lights, and watchmen for protection of workers and the public and shall post danger signs warning against hazards created by such features in the course of construction.

6.14.8 Hazards Control – Contractor shall store volatile wastes in covered metal containers and remove them from the Site daily. Contractor shall prevent accumulation of wastes that create hazardous conditions. Contractor shall provide adequate ventilation during use of volatile or noxious substances.

6.14.9 Contractor shall designate a responsible member of its organization on the Project, whose duty shall be to post information regarding protection and obligations of workers and other notices required under occupational safety and health laws, to comply with reporting and other occupational safety requirements, and to protect the life, safety, and health of workers. Name and position of person so designated shall be reported to District by Contractor.

6.14.10 Contractor shall correct any violations of safety laws, rules, orders, standards, or regulations. Upon the issuance of a citation or notice of violation by the Division of Occupational Safety and Health, Contractor shall correct such violation promptly.

6.14.11 Contractor shall comply with any District storm water requirements that are approved by the District and applicable to the Project, at no additional cost to the District.

6.14.12 In an emergency affecting safety of life or of work or of adjoining property, Contractor, without special instruction or authorization, shall act, at its discretion, to prevent such threatened loss or injury. Any compensation claimed by Contractor on account of emergency work shall be determined by agreement.

6.14.13 All salvage materials will become the property of the Contractor and shall be removed from the Site unless otherwise called for in the Contract Documents. However, the District reserves the right to designate certain items of value that shall be turned over to the District unless otherwise directed by District.

6.14.14 All connections to public utilities and/or existing on-site services shall be made and maintained in such a manner as to not interfere with the continuing use of same by the District during the entire progress of the Work.

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6.14.15 Contractor shall provide such heat, covering, and enclosures as are necessary to protect all Work, materials, equipment, appliances, and tools against damage by weather conditions, such as extreme heat, cold, rain, snow, dry winds, flooding, or dampness.

6.14.16 The Contractor shall protect and preserve the Work from all damage or accident, providing any temporary roofs, window and door coverings, boxings, or other construction as required by the Architect. The Contractor shall be responsible for existing structures, walks, roads, trees, landscaping, and/or improvements in working areas; and shall provide adequate protection therefore. If temporary removal is necessary of any of the above items, or damage occurs due to the Work, the Contractor shall replace same at its expense with same kind, quality, and size of Work or item damaged. This shall include any adjoining property of the District and others.

6.14.17 Contractor shall take adequate precautions to protect existing roads, sidewalks, curbs, pavements, utilities, adjoining property, and structures (including, without limitation, protection from settlement or loss of lateral support), and to avoid damage thereto, and repair any damage thereto caused by construction operations.

6.14.18 Contractor shall confine apparatus, the storage of materials, and the operations of workers to limits indicated by law, ordinances, permits, or directions of Architect, and shall not interfere with the Work or unreasonably encumber Premises or overload any structure with materials. Contractor shall enforce all instructions of District and Architect regarding signs, advertising, fires, and smoking, and require that all workers comply with all regulations while on Project Site.

6.14.19 Contractor, Contractor's employees, Subcontractors, Subcontractors' employees, or any person associated with the Work shall conduct themselves in a manner appropriate for a school site. No verbal or physical contact with neighbors, students, and faculty, profanity, or inappropriate attire or behavior will be permitted. District may require Contractor to permanently remove non-complying persons from Project Site.

6.14.20 Contractor shall take care to prevent disturbing or covering any survey markers, monuments, or other devices marking property boundaries or corners. If such markers are disturbed, Contractor shall have a civil engineer, registered as a professional engineer in California, replace them at no cost to District.

6.14.21 In the event that the Contractor enters into any agreement with owners of any adjacent property to enter upon the adjacent property for the purpose of performing the Work, Contractor shall fully indemnify, defend, and hold harmless each person, entity, firm, or agency that owns or has any interest in adjacent property. The form and content of the agreement of indemnification shall be approved by the District prior to the commencement of any Work on or about the adjacent property. The Contractor shall also indemnify the District as provided in the indemnification provision herein. These provisions shall be in addition to any other requirements of the owners of the adjacent property.

6.15 Working Evenings and Weekends

Contractor may be required to work increased hours, evenings, and/or weekends at no additional cost to the District. Contractor shall give the District seventy-two (72) hours' notice prior to performing any evening and/or weekend work. Contractor shall perform all evening and/or weekend work only upon District's approval and in compliance with all applicable rules, regulations, laws, and local ordinances including, without limitation, all noise and light limitations. Contractor shall reimburse the District for

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any increased or additional Inspector charges as a result of Contractor's increased hours, or evening and/or weekend work.

6.16 Cleaning Up

6.16.1 The Contractor shall provide all services, labor, materials, and equipment necessary for protecting and securing the Work, all school occupants, furnishings, equipment, and building structure from damage until its completion and final acceptance by District. Dust barriers shall be provided to isolate dust and dirt from construction operations. At completion of the Work and portions thereof, Contractor shall clean to the original state any areas beyond the Work area that become dust laden as a result of the Work. The Contractor must erect the necessary warning signs and barricades to ensure the safety of all school occupants. The Contractor at all times must maintain good housekeeping practices to reduce the risk of fire damage and must make a fire extinguisher, fire blanket, and/or fire watch, as applicable, available at each location where cutting, braising, soldering, and/or welding is being performed or where there is an increased risk of fire.

6.16.2 Contractor at all times shall keep Premises, including property immediately adjacent thereto, free from debris such as waste, rubbish (including personal rubbish of workers, e.g., food wrappers, etc.), and excess materials and equipment caused by the Work. Contractor shall not leave debris under, in, or about the Premises (or surrounding property or neighborhood), but shall promptly remove same from the Premises on a daily basis. If Contractor fails to clean up, District may do so and the cost thereof shall be charged to Contractor. If Contract is for work on an existing facility, Contractor shall also perform specific clean-up on or about the Premises upon request by the District as it deems necessary for continued operations. Contractor shall comply with all related provisions of the Specifications.

6.16.3 If the Construction Manager, Architect, or District observes the accumulation of trash and debris, the District will give the Contractor a 24-hour written notice to mitigate the condition.

6.16.4 Should the Contractor fail to perform the required clean-up, or should the clean-up be deemed unsatisfactory by the District, the District may, at its sole discretion, then perform the clean-up. All cost associated with the clean-up work (including all travel, payroll burden, and costs for supervision) will be deducted from the Contract Price.

7. SUBCONTRACTORS

7.1 Contractor shall provide the District with information for all Subcontracts as indicated in the Contractor's Submittals and Schedules Section herein.

7.2 No contractual relationship exists between the District and any Subcontractor, supplier, or sub-subcontractor by reason of this Contract.

7.3 Contractor agrees to bind every Subcontractor by terms of this Contract as far as those terms that are applicable to Subcontractor's work including, without limitation, all labor, wage & hour, apprentice and related provisions and requirements. If Contractor shall subcontract any part of this Contract, Contractor shall be as fully responsible to District for acts and omissions of any Subcontractor and of persons either directly or indirectly employed by any Subcontractor, including Subcontractor caused Project delays, as it is for acts and omissions of persons directly employed by Contractor. The divisions or sections of the Specifications and/or the arrangement of the drawings

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are not intended to control the Contractor in dividing the Work among Subcontractors or limit the work performed by any trade.

7.4 District's consent to, or approval of, or failure to object to, any Subcontractor under this Contract shall not in any way relieve Contractor of any obligations under this Contract and no such consent shall be deemed to waive any provisions of this Contract.

7.5 Contractor is directed to familiarize itself with sections 4100 through 4114 of the Public Contract Code of the State of California, as regards subletting and subcontracting, and to comply with all applicable requirements therein. In addition, Contractor is directed to familiarize itself with sections 1720 through 1861 of the Labor Code of the State of California, as regards the payment of prevailing wages and related issues, and to comply with all applicable requirements therein including, without limitation, section 1775 and the Contractor's and Subcontractors' obligations and liability for violations of prevailing wage law and other applicable laws.

7.6 No Contractor whose Bid is accepted shall, without consent of the awarding authority and in full compliance with section 4100 et seq. of the Public Contract Code, including, without limitation, sections 4107, 4107.5, and 4109 of the Public Contract Code, and section 1771.1 of the Labor Code, either:

7.6.1 Substitute any person as a Subcontractor in place of the Subcontractor designated in the original Bid; or

7.6.2 Permit any Subcontract to be assigned or transferred, or allow any portion of the Work to be performed by anyone other than the original Subcontractor listed in the Bid; or

7.6.3 Sublet or subcontract any portion of the Work in excess of one-half of one percent (0.5%) of the Contractor's total bid as to which its original bid did not designate a Subcontractor.

7.7 The Contractor shall be responsible for the coordination of the trades, Subcontractors, sub-subcontractors, and material or equipment suppliers working on the Project.

7.7.1 Contractor is responsible for ensuring that all Subcontractors are properly registered as public works contractors by the Department of Industrial Relations.

7.8 Contractor is solely responsible for settling any differences between the Contractor and its Subcontractor(s) or between Subcontractors.

7.9 Contractor must include in all of its subcontracts the assignment provisions as indicated in the Termination section of these General Conditions.

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8. **OTHER CONTRACTS/CONTRACTORS**

8.1 District reserves the right to let other contracts, and/or to perform work with its own forces, in connection with the Project. Contractor shall afford other contractors reasonable opportunity for introduction and storage of their materials and execution of their work and shall properly coordinate and connect Contractor's Work with the work of other contractors.

8.2 In addition to Contractor's obligation to protect its own Work, Contractor shall protect the work of any other contractor that Contractor encounters while working on the Project.

8.3 If any part of Contractor's Work depends for proper execution or results upon work of District or any other contractor, the Contractor shall inspect and, before proceeding with its Work, promptly report to the District in writing any defects in District's or any other contractor's work that render Contractor's Work unsuitable for proper execution and results. Contractor shall be held accountable for damages to District for District's or any other contractor's work that Contractor failed to inspect or should have inspected. Contractor's failure to inspect and report shall constitute Contractor's acceptance of all District's or any other contractor's work as fit and proper for reception of Contractor's Work, except as to defects that may develop in District's or any other contractor's work after execution of Contractor's Work and not caused by execution of Contractor's Work.

8.4 To ensure proper execution of its subsequent work, Contractor shall measure and inspect work already in place and shall at once report to the District in writing any discrepancy between that executed work and the Contract Documents.

8.5 Contractor shall ascertain to its own satisfaction the scope of the Project and nature of District's or any other contracts that have been or may be awarded by District in prosecution of the Project to the end that Contractor may perform this Contract in light of the other contracts, if any.

8.6 Nothing herein contained shall be interpreted as granting to Contractor exclusive occupancy of the Site, the Premises, or of the Project. Contractor shall not cause any unnecessary hindrance or delay to the use and/or operation(s) of the Premises and/or to District or any other contractor working on the Project. If simultaneous execution of any contract or Premises operation is likely to cause interference with performance of Contractor's Contract, Contractor shall coordinate with those contractor(s), person(s), and/or entity(s) and shall notify the District of the resolution.

9. **DRAWINGS AND SPECIFICATIONS**

9.1 A complete list of all Drawings that form a part of the Contract is to be found as an index on the Drawings themselves, and/or may be provided to the Contractor and/or in the Table of Contents.

9.2 Materials or Work described in words that so applied have a well-known technical or trade meaning shall be deemed to refer to recognized standards, unless noted otherwise.

9.3 Trade Name or Trade Term. It is not the intention of this Contract to go into detailed descriptions of any materials and/or methods commonly known to the trade under "trade name" or "trade term." The mere mention or notation of "trade name" or "trade term" shall be considered a

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sufficient notice to Contractor that it will be required to complete the work so named, complete, finished, and operable, with all its appurtenances, according to the best practices of the trade.

9.4 The naming of any material and/or equipment shall mean furnishing and installing of same, including all incidental and accessory items thereto and/or labor therefor, as per best practices of the trade(s) involved, unless specifically noted otherwise.

9.5 Contract Documents are complementary, and what is called for by one shall be binding as if called for by all. As such, Drawings and Specifications are intended to be fully cooperative and to agree. However, if Contractor observes that Drawings and Specifications are in conflict with the Contract Documents, Contractor shall promptly notify District and Architect in writing, and any necessary changes shall be made as provided in the Contract Documents.

9.6 In the case of discrepancy or ambiguity in the Contract Documents, the order of precedence in the Agreement shall prevail. However, in the case of discrepancy or ambiguity solely between and among the Drawings and Specifications, the discrepancy or ambiguity shall be resolved in favor of the interpretation that will provide District with the functionally complete and operable Project described in the Drawings and Specifications. In case of ambiguity, conflict, or lack of information, District will furnish clarifications with reasonable promptness.

9.7 Drawings and Specifications are intended to comply with all laws, ordinances, rules, and regulations of constituted authorities having jurisdiction, and where referred to in the Contract Documents, the laws, ordinances, rules, and regulations shall be considered as a part of the Contract within the limits specified. Contractor shall bear all expense of correcting work done contrary to said laws, ordinances, rules, and regulations.

9.9 As required by Section 4-317(c), Part 1, Title 24, CCR: "Should any existing conditions such as deterioration or non-complying construction be discovered which is not covered by the 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."

9.9 Ownership of Drawings

All copies of Plans, Drawings, Designs, Specifications, and copies of other incidental architectural and engineering work, or copies of other Contract Documents furnished by District, are the property of District. They are not to be used by Contractor in other work and, with the exception of signed sets of Contract Documents, are to be returned to District on request at completion of Work, or may be used by District as it may require without any additional costs to District. Neither the Contractor nor any Subcontractor, or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications, and other documents prepared by the Architect. District hereby grants the Contractor, Subcontractors, sub-subcontractors, and material or equipment suppliers a limited license to use applicable portions of the Drawings prepared for the Project in the execution of their Work under the Contract Documents.

10. CONTRACTOR'S SUBMITTALS AND SCHEDULES

Contractor's submittals shall comply with the provisions and requirements of the Specifications including, without limitation Submittals.

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10.1 Schedule of Work, Schedule of Submittals, and Schedule of Values

10.1.1 Within **TEN (10)** calendar days after the date of the Notice to Proceed (unless otherwise specified in the Specifications), the Contractor shall prepare and submit to the District for review, in a form supported by sufficient data to substantiate its accuracy as the District may require:

10.1.1.1 Preliminary Schedule. A preliminary schedule of construction indicating the starting and completion dates of the various stages of the Work, including any information and following any form as may be specified in the Specifications. Once approved by District, this shall become the Construction Schedule. This schedule shall include and identify all tasks that are on the Project's critical path with a specific determination of the start and completion of each critical path task as well as all Contract milestones and each milestone's completion date(s) as may be required by the District.

10.1.1.1.1 The District is not required to approve a preliminary schedule of construction with early completion, i.e., one that shows early completion dates for the Work and/or milestones. Contractor shall not be entitled to extra compensation if the District approves a Construction Schedule with an early completion date and Contractor completes the Project beyond the date shown in the schedule but within the Contract Time. A Construction Schedule showing the Work completed in less than the Contract Time, the time between the early completion date and the end of the Contract Time shall be Float

10.1.1.2 Preliminary Schedule of Values. **Contractor is responsible for providing a Schedule of Values for each Increment (2 Total).** A preliminary schedule of values for all of the Work, which must include quantities and prices of items aggregating the Contract Price and must subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. The Preliminary Schedule of Values will include all disciplines and the component parts. Unless the Special Conditions contain different limits, this preliminary schedule of values shall include, at a minimum, the following information and the following structure:

10.1.1.2.1 Divided into at least the following categories:

- 10.1.1.2.1.1** Overhead and profit;
- 10.1.1.2.1.2** Supervision;
- 10.1.1.2.1.3** General conditions;
- 10.1.1.2.1.4** Layout;
- 10.1.1.2.1.5** Mobilization;
- 10.1.1.2.1.6** Submittals;
- 10.1.1.2.1.7** Bonds and insurance;
- 10.1.1.2.1.8** Close-out/Certification documentation;
- 10.1.1.2.1.9** Demolition;
- 10.1.1.2.1.10** Installation;
- 10.1.1.2.1.11** Rough-in;
- 10.1.1.2.1.12** Finishes;
- 10.1.1.2.1.13** Testing;
- 10.1.1.2.1.14** Specification Section;
- 10.1.1.2.1.15** Punchlist and District acceptance.

10.1.1.2.2 And also divided by each of the following areas:

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- 10.1.1.2.2.1 Increment;
- 10.1.1.2.2.2 Site work;
- 10.1.1.2.2.3 By each building;
- 10.1.1.2.2.4 By each floor and/or use area;
- 10.1.1.2.2.5 By each roof.

10.1.1.2.3 The preliminary schedule of values shall not provide for values any greater than the following percentages of the Contract value:

- 10.1.1.2.3.1 Mobilization and layout combined to equal not more than 1%;
- 10.1.1.2.3.2 Submittals, samples and shop drawings combined to equal not more than 3%;
- 10.1.1.2.3.3 Bonds and insurance combined to equal not more than 2%.
- 10.1.1.2.3.4 Closeout documentation shall have a value in the preliminary schedule of not less than 5%.

10.1.1.2.4 Notwithstanding any provision of the Contract Documents to the contrary, payment of the Contractor's overhead, supervision, general conditions costs, and profit, as reflected in the Cost Breakdown, shall be paid based on percentage complete, with the disbursement of Progress Payments and the Final Payment.

10.1.1.2.5 Contractor shall certify that the preliminary schedule of values as submitted to the District is accurate and reflects the costs as developed in preparing Contractor's bid. For example, without limiting the foregoing, Contractor shall not "front-load" the preliminary schedule of values with dollar amounts greater than the value of activities performed early in the Project.

10.1.1.2.6 The preliminary schedule of values shall be subject to the District's review and approval of the form and content thereof. In the event that the District objects to any portion of the preliminary schedule of values, the District shall notify the Contractor, in writing, of the District's objection(s) to the preliminary schedule of values. Within five (5) calendar days of the date of the District's written objection(s), Contractor shall submit a revised preliminary schedule of values to the District for review and approval. The foregoing procedure for the preparation, review and approval of the preliminary schedule of values shall continue until the District has approved the entirety of the preliminary schedule of values.

10.1.1.2.7 Once the preliminary schedule of values is approved by the District, this shall become the Schedule of Values. The Schedule of Values shall not be thereafter modified or amended by the Contractor without the prior consent and approval of the District, which may be granted or withheld in the sole discretion of the District.

10.1.1.3 Preliminary Schedule of Submittals. A preliminary schedule of submittals, including Shop Drawings, Product Data, and Samples submittals. Once approved by District, this shall become the Submittal Schedule. All submittals shall be forwarded to the District by the date indicated on the approved Submittal Schedule, unless an earlier date is necessary to maintain the Construction Schedule, in which case those submittals shall be forwarded to the District so as not to delay the Construction Schedule. Upon request by the District, Contractor shall provide an electronic copy of all submittals to the District. All submittals shall be submitted no later than 90 days after the Notice to Proceed.

10.1.1.4 Safety Plan. Contractor's Safety Plan specifically adapted for the Project. Contractor's Safety Plan shall comply with the following requirements:

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10.1.1.4.1 All applicable requirements of California Division of Occupational Safety and Health ("CalOSHA") and/or of the United States Occupational Safety and Health Administration ("OSHA").

10.1.1.4.2 All provisions regarding Project safety, including all applicable provisions in these General Conditions.

10.1.1.4.3 Contractor's Safety Plan shall be in English and in the language(s) of the Contractor's and its Subcontractors' employees.

10.1.1.5 Complete Registered Subcontractors List. The name, address, telephone number, facsimile number, California State Contractors License number, classification, DIR registration number and monetary value of all Subcontracts of any tier for parties furnishing labor, material, or equipment for completion of the Project.

10.1.2 Contractor must provide all schedules both in hard copy and electronically, in a format (e.g., Microsoft Project or Primavera) approved in advance by the District.

10.1.3 The District will review the schedules submitted and the Contractor shall make changes and corrections in the schedules as requested by the District and resubmit the schedules until approved by the District.

10.1.4 The District shall have the right at any time to revise the schedule of values if, in the District's sole opinion, the schedule of values does not accurately reflect the value of the Work performed.

10.1.5 All submittals and schedules must be approved by the District before Contractor can rely on them as a basis for payment.

10.2 Monthly Progress Schedule(s)

10.2.1 Contractor shall provide Monthly Progress Schedule(s) to the District. A Monthly Progress Schedule shall update the approved Construction Schedule or the last Monthly Progress Schedule, showing all work completed and to be completed as well as updating the Registered Subcontractors List. The monthly Progress Schedule shall be sent within the timeframe requested by the District and shall be in a format acceptable to the District and contain a written narrative of the progress of work that month and any changes, delays, or events that may affect the work. The process for District approval of the Monthly Progress Schedule shall be the same as the process for approval of the Construction Schedule.

10.2.2 Contractor shall submit Monthly Progress Schedule(s) with all payment applications.

10.2.3 Contractor must provide all schedules both in hard copy and electronically, in a format (e.g., Microsoft Project or Primavera) approved in advance by the District.

10.2.4 The District will review the schedules submitted and the Contractor shall make changes and corrections in the schedules as requested by the District and resubmit the schedules until approved by the District.

10.2.5 The District shall have the right at any time to revise the schedule of values if, in the District's sole opinion, the schedule of values does not accurately reflect the value of the Work performed.

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10.2.6 All submittals and schedules must be approved by the District before Contractor can rely on them as a basis for payment.

10.3 Material Safety Data Sheets (MSDS)

Contractor is required to ensure Material Safety Data Sheets are available in a readily accessible place at the Site for any material requiring a Material Safety Data Sheet per the federal "Hazard Communication" standard, or employees' "right to know" law. The Contractor is also required to ensure proper labeling on substances brought onto the job site and that any person working with the material or within the general area of the material is informed of the hazards of the substance and follows proper handling and protection procedures. Two additional copies of the Material Safety Data Sheets shall also be submitted directly to the District.

11. SITE ACCESS, CONDITIONS, AND REQUIREMENTS

11.1 Site Investigation

Before bidding on this Work, Contractor shall make a careful investigation of the Site and thoroughly familiarize itself with the requirements of the Contract. By the act of submitting a bid for the Work included in this Contract, Contractor shall be deemed to have made a complete study and investigation, and to be familiar with and accepted the existing conditions of the Site.

Prior to commencing the Work, Contractor and the District's representative shall survey the Site to document the condition of the Site. Contractor will record the survey in digital videotape format and provide an electronic copy to the District within fourteen (14) days of the survey. This electronic record shall serve as a basis for determining any damages caused by the Contractor during the Project. The Contractor may also document any pre-existing conditions in writing, provided that both the Contractor and the District's representative agree on said conditions and sign a memorandum documenting the same.

11.2 Soils Investigation Report

11.2.1 When a soils investigation report obtained from test holes at Site or for the Project is available, that report may be available to the Contractor but shall not be a part of this Contract and shall not alleviate or excuse the Contractor's obligation to perform its own investigation. Any information obtained from that report or any information given on Drawings as to subsurface soil condition or to elevations of existing grades or elevations of underlying rock is approximate only, is not guaranteed, does not form a part of this Contract, and Contractor may not rely thereon. By submitting its bid, Contractor acknowledges that it has made visual examination of Site and has made whatever tests Contractor deems appropriate to determine underground condition of soil. Although any such report is not a part of this Contract, recommendations from the report may be included in the Drawings, Specifications, or other Contract Documents. It is Contractor's sole responsibility to thoroughly review all Contract Documents, Drawings, and Specifications.

11.2.2 Contractor agrees that no claim against District will be made by Contractor for damages and hereby waives any rights to damages if, during progress of Work, Contractor encounters subsurface or latent conditions at Site materially differing from those shown on Drawings or indicated in Specifications, or for unknown conditions of an unusual nature that differ materially from those ordinarily encountered in the work of the character provided for in Plans and Specifications, except as indicated in the provisions of these General Conditions regarding trenches, trenching, and/or existing utility lines.

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11.3 Access to Work

District and its representatives shall at all times have access to Work wherever it is in preparation or progress, including storage and fabrication. Contractor shall provide safe and proper facilities for such access so that District's representatives may perform their functions.

11.4 Layout and Field Engineering

11.4.1 All field engineering required for layout of this Work and establishing grades for earthwork operations shall be furnished by Contractor at its expense. This Work shall be done by a qualified, California-registered civil engineer approved in writing by District and Architect. Any required Record and/or As-Built of Site development shall be prepared by the approved civil engineer.

11.4.2 The Contractor shall be responsible for having ascertained pertinent local conditions such as location, accessibility, and general character of the Site and for having satisfied itself as to the conditions under which the Work is to be performed. Contractor shall follow best practices, including but not limited to potholing to avoid utilities. District shall not be liable for any claim for allowances because of Contractor's error, failure to follow best practices, or negligence in acquainting itself with the conditions at the Site.

11.4.3 Contractor shall protect and preserve established benchmarks and monuments and shall make no changes in locations without the prior written approval of District. Contractor shall replace any benchmarks or monuments that are lost or destroyed subsequent to proper notification of District and with District's approval.

11.5 Utilities

Utilities shall be provided as indicated in the Specifications.

11.6 Sanitary Facilities

Sanitary facilities shall be provided as indicated in the Specifications.

11.7 Surveys

Contractor shall provide surveys done by a California-licensed civil engineer surveyor to determine locations of construction, grading, and site work as required to perform the Work.

11.8 Regional Notification Center

The Contractor, except in an emergency, shall contact the appropriate regional notification center at least two (2) days prior to commencing any excavation if the excavation will be conducted in an area or in a private easement that is known, or reasonably should be known, to contain subsurface installations other than the underground facilities owned or operated by the District, and obtain an inquiry identification number from that notification center. No excavation shall be commenced and/or carried out by the Contractor unless an inquiry identification number has been assigned to the Contractor or any Subcontractor and the Contractor has given the District the identification number. Any damages arising from Contractor's failure to make appropriate notification shall be at the sole risk and expense of the Contractor. Any delays caused by failure to make appropriate notification shall be at the sole risk of the Contractor and shall not be considered for an extension of the Contract Time.

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11.9 Existing Utility Lines

11.9.1 Pursuant to Government Code section 4215, District assumes the responsibility for removal, relocation, and protection of main or trunk utility lines and facilities located on the construction Site at the time of commencement of construction under this Contract with respect to any such utility facilities that are not identified in the Plans and Specifications. Contractor shall not be assessed for liquidated damages for delay in completion of the Project caused by failure of District or the owner of a utility to provide for removal or relocation of such utility facilities.

11.9.2 Locations of existing utilities provided by District shall not be considered exact, but approximate within a reasonable margin and shall not relieve Contractor of responsibilities to exercise reasonable care or costs of repair due to Contractor's failure to do so. District shall compensate Contractor for the costs of locating and repairing damage not due to the failure of Contractor to exercise reasonable care, and removing or relocating such utility facilities not indicated in the Plans and Specifications with reasonable accuracy, and for equipment necessarily idle during such work.

11.9.3 No provision herein shall be construed to preclude assessment against Contractor for any other delays in completion of the Work. Nothing in this Article shall be deemed to require District to indicate the presence of existing service laterals, appurtenances, or other utility lines, within the exception of main or trunk utility lines or whenever the presence of these utilities on the Site of the construction Project can be inferred from the presence of other visible facilities, such as buildings, meter junction boxes, on or adjacent to the Site of the construction.

11.9.4 If Contractor, while performing Work under this Contract, discovers utility facilities not identified by District in Contract Plans and Specifications, Contractor shall immediately notify the District and the utility in writing. The cost of repair for damage to above-mentioned visible facilities without prior written notification to the District shall be borne by the Contractor.

11.10 Notification

Contractor understands, acknowledges and agrees that the purpose of prompt notification to the District pursuant to these provisions is to allow the District to investigate the condition(s) so that the District shall have the opportunity to decide how the District desires to proceed as a result of the condition(s). Accordingly, failure of Contractor to promptly notify the District in writing, pursuant to these provisions, shall constitute Contractor's waiver of any claim for damages or delay incurred as a result of the condition(s).

11.11 Hazardous Materials

Contractor shall comply with all provisions and requirements of the Contract Documents related to hazardous materials including, without limitation, Hazardous Materials Procedures and Requirements.

11.12 No Signs

Neither the Contractor nor any other person or entity shall display any signs not required by law or the Contract Documents at the Site, fences trailers, offices, or elsewhere on the Site without specific prior written approval of the District.

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12. **TRENCHES**

12.1 **Trenches Greater Than Five Feet**

Pursuant to Labor Code section 6705, if the Contract Price exceeds \$25,000 and involves the excavation of any trench or trenches five (5) feet or more in depth, the Contractor shall, in advance of excavation, promptly submit to the District and/or a registered civil or structural engineer employed by the District or Architect, a detailed plan, stamped by a licensed engineer retained by the Contractor, showing the design of shoring for protection from the hazard of caving ground during the excavation of such trench or trenches.

12.2 **Excavation Safety**

If such plan varies from the Shoring System Standards established by the Construction Safety Orders, the plan shall be prepared by a registered civil or structural engineer, but in no case shall such plan be less effective than that required by the Construction Safety Orders. No excavation of such trench or trenches shall be commenced until said plan has been accepted by the District or by the person to whom authority to accept has been delegated by the District.

12.3 **No Tort Liability of District**

Pursuant to Labor Code section 6705, nothing in this Article shall impose tort liability upon the District or any of its employees.

12.4 **No Excavation without Permits**

The Contractor shall not commence any excavation Work until it has secured all necessary permits including the required CalOSHA excavation/shoring permit. Any permits shall be prominently displayed on the Site prior to the commencement of any excavation.

12.5 **Discovery of Hazardous Waste and/or Unusual Conditions**

12.5.1 Pursuant to Public Contract Code section 7104, 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, in writing, of any:

12.5.1.1 Material that the Contractor believes may be material that is hazardous waste, as defined in section 25117 of the Health and Safety Code, is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law.

12.5.1.2 Subsurface or latent physical conditions at the Site differing from those indicated.

12.5.1.3 Unknown physical conditions at the Site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract.

12.5.2 The District shall promptly investigate the conditions, and if it finds that the conditions do materially so differ, or do involve hazardous waste, and cause a decrease or increase in the Contractor's cost of, or the time required for, performance of any part of the Work, shall issue a Change Order under the procedures described herein.

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12.5.3 In the event that a dispute arises between District and the Contractor whether the conditions materially differ, or involve hazardous waste, or cause a decrease or increase in the Contractor's cost of, or time required for, performance of any part of the Work, the Contractor shall not be excused from any scheduled completion date provided for by the Contract, but shall proceed with all work to be performed under the Contract. The Contractor shall retain any and all rights provided either by Contract or by law that pertain to the resolution of disputes and protests.

13. INSURANCE AND BONDS

13.1 Insurance

Unless different provisions and/or limits are indicated in the Special Conditions, all insurance required of Contractor and/or its Subcontractor(s) shall be at least as broad as the amounts and include the provisions set forth herein.

13.1.1 Commercial General Liability and Automobile Liability Insurance

13.1.1.1 Contractor shall procure and maintain, during the life of this Contract, Commercial General Liability Insurance and Automobile Liability Insurance that shall protect Contractor, District, State, Construction Manager(s), Project Inspector(s), and Architect(s) from all claims for bodily injury, property damage, personal injury, death, advertising injury, and medical payments arising from, or in connection with, operations under this Contract. This coverage shall be provided in a form at least as broad as Insurance Services (ISO) Form CG 0001 11188. Contractor shall ensure that Products Liability and Completed Operations coverage, Fire Damage Liability coverage, and Automobile Liability Insurance coverage including owned, non-owned, and hired automobiles, are included within the above policies and at the required limits, or Contractor shall procure and maintain these coverages separately.

13.1.1.2 Contractor's deductible or self-insured retention for its Commercial General Liability Insurance policy shall not exceed \$25,000 unless approved in writing by District.

13.1.1.3 All such policies shall be written on an occurrence form.

13.1.2 Excess Liability Insurance

13.1.2.1 If Contractor's underlying policy limits are less than required, subject to the District's sole discretion, Contractor may procure and maintain, during the life of this Contract, an Excess Liability Insurance Policy to meet the policy limit requirements of the required policies in order to satisfy, in the aggregate with its underlying policy, the insurance requirements herein.

13.1.2.2 There shall be no gap between the per occurrence amount of any underlying policy and the start of the coverage under the Excess Liability Insurance Policy. Any Excess Liability Insurance Policy shall be written on a following form and shall protect Contractor, District, State, Construction Manager(s), Project Manager(s), and Architect(s) in amounts and including the provisions as set forth in the Supplementary Conditions (if any) and/or Special Conditions, and that complies with all requirements for Commercial General Liability and Automobile Liability and Employers' Liability Insurance.

13.1.2.3 The District, in its sole discretion, may accept an Excess Liability Insurance Policy that brings Contractor's primary limits to the minimum requirements herein.

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13.1.3 Subcontractor(s): Contractor shall require its Subcontractor(s), if any, to procure and maintain Commercial General Liability Insurance, Automobile Liability Insurance, and Excess Liability Insurance (if Subcontractor elects to satisfy, in part the insurance required herein by procuring and maintaining an Excess Liability Insurance Policy) with forms of coverage and limits equal to the amounts required of the Contractor.

13.1.4 Workers' Compensation and Employers' Liability Insurance

13.1.4.1 In accordance with provisions of section 3700 of the California Labor Code, the Contractor and every Subcontractor shall be required to secure the payment of compensation to its employees.

13.1.4.2 Contractor shall procure and maintain, during the life of this Contract, Workers' Compensation Insurance and Employers' Liability Insurance for all of its employees engaged in work under this Contract, on/or at the Site of the Project. This coverage shall cover, at a minimum, medical and surgical treatment, disability benefits, rehabilitation therapy, and survivors' death benefits. Contractor shall require its Subcontractor(s), if any, to procure and maintain Workers' Compensation Insurance and Employers' Liability Insurance for all employees of Subcontractor(s). Any class of employee or employees not covered by a Subcontractor's insurance shall be covered by Contractor's insurance. If any class of employee or employee engaged in Work under this Contract, on or at the Site of the Project, is not protected under the Workers' Compensation Insurance, Contractor shall provide, or shall cause a Subcontractor to provide, adequate insurance coverage for the protection of any employee(s) not otherwise protected before any of those employee(s) commence work.

13.1.5 Builder's Risk Insurance: Builder's Risk "All Risk" Insurance

Contractor shall procure and maintain, during the life of this Contract, Builder's Risk (Course of Construction), or similar first party property coverage acceptable to the District, issued on a replacement cost value basis. The cost shall be consistent with the total replacement cost of all insurable Work of the Project included within the Contract Documents. Coverage is to insure against all risks of accidental physical loss and shall include without limitation the perils of vandalism and/or malicious mischief (both without any limitation regarding vacancy or occupancy), sprinkler leakage, civil authority, theft, sonic disturbance, earthquake, flood, collapse, wind, rain, dust, fire, war, terrorism, lightning, smoke, and rioting. Coverage shall include debris removal, demolition, increased costs due to enforcement of all applicable ordinances and/or laws in the repair and replacement of damaged and undamaged portions of the property, and reasonable costs for the Architect's and engineering services and expenses required as a result of any insured loss upon the Work and Project, including completed Work and Work in progress, to the full insurable value thereof.

13.1.6 Pollution Liability Insurance

13.1.6.1 Contractor shall procure and maintain Pollution Liability Insurance that shall protect Contractor, District, State, Construction Manager(s), Project Inspector(s), and Architect(s) from all claims for bodily injury, property damage, including natural resource damage, cleanup costs, removal, storage, disposal, and/or use of the pollutant arising from operations under this Contract, and defense, including costs and expenses incurred in the investigation, defense, or settlement of claims. Coverage shall apply to sudden and/or gradual pollution conditions resulting from the escape or release of smoke, vapors, fumes, acids, alkalis, toxic chemicals, liquids, or gases, natural gas, waste materials, or other irritants, contaminants, or pollutants, including asbestos. This coverage shall be provided in

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a form at least as broad as Insurance Services Offices, Inc. (ISO) Form CG 2415, or Contractor shall procure and maintain these coverages separately.

13.1.6.2 Contractor warrants that any retroactive date applicable to coverage under the policy shall predate the effective date of the Contract and that continuous coverage will be maintained or an extended reporting or discovery period will be exercised for a period of three (3) years, beginning from the time that the Work under the Contract is completed.

13.1.6.3 If Contractor is responsible for removing any pollutants from a site, then Contractor shall ensure that Any Auto, including owned, non-owned, and hired, is included within the above policies and at the required limits, to cover its automobile exposure from transporting the pollutants from the site to an approved disposal site. This coverage shall include the Motor Carrier Act Endorsement, MCS 90.

13.1.7 Proof of Insurance and Other Requirements: Endorsements and Certificates

13.1.7.1 Contractor shall not commence Work nor shall it allow any Subcontractor to commence Work under this Contract, until Contractor and its Subcontractor(s) have procured all required insurance and Contractor has delivered in duplicate to the District complete endorsements (or entire insurance policies) and certificates indicating the required coverages have been obtained, and the District has approved these documents.

13.1.7.2 Endorsements, certificates, and insurance policies shall include the following:

13.1.7.2.1 A clause stating the following, or other language acceptable to the District:

"This policy shall not be canceled until written notice to District, Architect, and Construction Manager stating date of the cancellation by the insurance carrier. Date of cancellation may not be less than thirty (30) days after date of mailing notice."

13.1.7.2.2 Language stating in particular those insured, extent of insurance, location and operation to which insurance applies, expiration date, to whom cancellation and reduction notice will be sent, and length of notice period.

13.1.7.2.3 All endorsements, certificates and insurance policies shall state that District, its trustees, employees and agents, the State of California, Construction Manager(s), Project Manager(s), Inspector(s) and Architect(s) are named additional insureds under all policies except Workers' Compensation Insurance and Employers' Liability Insurance.

13.1.7.2.4 All endorsements shall waive any right to subrogation against any of the named additional insureds.

13.1.7.2.5 Contractor's and Subcontractors' insurance policy(s) shall be primary and non-contributory to any insurance or self-insurance maintained by District, its trustees, employees and/or agents, the State of California, Construction Manager(s), Project Manager(s), Inspector(s), and/or Architect(s).

13.1.7.2.6 Contractor's insurance limit shall apply separately to each insured against whom a claim is made or suit is brought.

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13.1.7.3 No policy shall be amended, canceled or modified, and the coverage amounts shall not be reduced, until Contractor or Contractor's broker has provided written notice to District, Architect(s), and Construction Manager(s) stating date of the amendment, modification, cancellation or reduction, and a description of the change. Date of amendment, modification, cancellation or reduction may not be less than thirty (30) days after date of mailing notice.

13.1.7.4 Insurance written on a "claims made" basis shall be retroactive to a date that coincides with or precedes Contractor's commencement of Work, including subsequent policies purchased as renewals or replacements. Said policy is to be renewed by the Contractor and all Subcontractors for a period of five (5) years following completion of the Work or termination of this Agreement. Such insurance must have the same coverage and limits as the policy that was in effect during the term of this Agreement, and will cover the Contractor and all Subcontractors for all claims made.

13.1.7.5 Unless otherwise stated in the Special Conditions, all of Contractor's insurance shall be with insurance companies with an A.M. Best rating of no less than **A: VII**.

13.1.7.6 The insurance requirements set forth herein shall in no way limit the Contractor's liability arising out of or relating to the performance of the Work or related activities.

13.1.7.7 Failure of Contractor and/or its Subcontractor(s) to comply with the insurance requirements herein shall be deemed a material breach of the Contract.

13.1.8 Insurance Policy Limits

13.1.8.1 Unless different limits are indicated in the Special Conditions, the limits of insurance shall not be less than the following amounts:

Commercial General Liability	Product Liability and Completed Operations, Fire Damage Liability – Split Limit	\$2,000,000 per occurrence; \$4,000,000 aggregate
Automobile Liability – Any Auto	Combined Single Limit	\$1,000,000
Workers' Compensation		Statutory limits pursuant to State law
Employers' Liability		\$1,000,000
Builder's Risk (Course of Construction)		Issued for the value and scope of Work indicated herein.
Pollution Liability		\$1,000,000 per claim; \$2,000,000 aggregate

13.1.8.2 If Contractor normally carries insurance in an amount greater than the minimum amounts required by District, that greater amount shall become the minimum required

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amount of insurance for purposes of the Contract. Therefore, Contractor hereby acknowledges and agrees that all insurance carried by it shall be deemed liability coverage for all actions it performs in connection with the Contract.

13.2 Contract Security - Bonds

13.2.1 Contractor shall furnish two surety bonds issued by a California admitted surety insurer as follows:

13.2.1.1 Performance Bond: A bond in an amount at least equal to one hundred percent (100%) of Contract Price as security for faithful performance of this Contract.

13.2.1.2 Payment Bond: A bond in an amount at least equal to one hundred percent (100%) of the Contract Price as security for payment of persons performing labor and/or furnishing materials in connection with this Contract.

13.2.2 Cost of bonds shall be included in the Bid and Contract Price.

13.2.3 All bonds related to this Project shall be in the forms set forth in these Contract Documents and shall comply with all requirements of the Contract Documents, including, without limitation, the bond forms.

14. WARRANTY/GUARANTEE/INDEMNITY

14.1 Warranty/Guarantee

14.1.1 The Contractor shall obtain and preserve for the benefit of the District, manufacturer's warranties on materials, fixtures, and equipment incorporated into the Work.

14.1.2 In addition to guarantees required elsewhere, Contractor shall, and hereby does guarantee and warrant all Work furnished on the job against all defects for a period of **TWO (2)** years after the later of the following dates, unless a longer period is provided for in the Contract Documents:

14.1.2.1 The acceptance by the District's governing board of the Work, subject to these General Conditions, or

14.1.2.2 The date that commissioning for the Project, if any, was completed.

At the District's sole option, Contractor shall repair or replace any and all of that Work, together with any other Work that may be displaced in so doing, that may prove defective in workmanship and/or materials within a **TWO (2)** year period from date of completion as defined above, unless a longer period is provided for in the Contract Documents, without expense whatsoever to District. In the event of failure of Contractor and/or Surety to commence and pursue with diligence said replacements or repairs within ten (10) days after being notified in writing, Contractor and Surety hereby acknowledge and agree that District is authorized to proceed to have defects repaired and made good at expense of Contractor and/or Surety who hereby agree to pay costs and charges therefore immediately on demand.

14.1.3 If, in the opinion of District, defective work creates a dangerous condition or requires immediate correction or attention to prevent further loss to District or to prevent interruption of District operations, District will attempt to give the notice required above. If Contractor or Surety cannot be contacted or neither complies with District's request for correction within a reasonable

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time as determined by District, District may, notwithstanding the above provision, proceed to make any and all corrections and/or provide attentions the District believes are necessary. The costs of correction or attention shall be charged against Contractor and Surety of the guarantees provided in this Article or elsewhere in this Contract.

14.1.4 The above provisions do not in any way limit the guarantees on any items for which a longer guarantee is specified or on any items for which a manufacturer gives a guarantee for a longer period. Contractor shall furnish to District all appropriate guarantee or warranty certificates as indicated in the Specifications or upon request by District.

14.1.5 Nothing herein shall limit any other rights or remedies available to District.

14.2 Indemnity and Defense

14.2.1 To the furthest extent permitted by California law, the Contractor shall indemnify, keep and hold harmless the District, the Architect(s), and the Construction Manager(s), their respective consultants, separate contractors, board members, officers, representatives, agents, and employees, in both individual and official capacities ("Indemnitees"), against all suits, claims, injury, damages, losses, and expenses ("Claims"), including but not limited to attorney's fees, caused by, arising out of, resulting from, or incidental to, in whole or in part, the performance of the Work under this Contract by the Contractor, its Subcontractors, vendors, or suppliers. However, the Contractor's indemnification and hold harmless obligation shall be reduced by the proportion of the Indemnitees' and/or Architect's liability to the extent the Claim(s) is/are caused by the sole negligence, active negligence, or willful misconduct of the Indemnitees, and/or defects in design furnished by the Architect, as found by a court or arbitrator of competent jurisdiction. This indemnification and hold harmless obligation of the Contractor shall not be construed to negate, abridge, or otherwise reduce any right or obligation of indemnity that would otherwise exist or arise as to Indemnitee or other person described herein. This indemnification and hold harmless obligation includes, but is not limited to, any failure or alleged failure by Contractor to comply with any provision of law, any failure or alleged failure to timely and properly fulfill all of its obligations under the Contract Documents in strict accordance with their terms, and without limitation, any failure or alleged failure of Contractor's obligations regarding any stop payment notice actions or liens, including Civil Wage and Penalty Assessments and/or Orders by the DIR.

14.2.2 To the furthest extent permitted by California law, Contractor shall also defend Indemnitees, at its own expense, including but not limited to attorneys' fees and costs, against all Claims caused by, arising out of, resulting from, or incidental to, in whole or in part, the performance of the Work under this Contract by the Contractor, its Subcontractors, vendors, or suppliers. However, without impacting Contractor's obligation to provide an immediate and ongoing defense of Indemnitees, the Contractor's defense obligation shall be retroactively reduced by the proportion of the Indemnitees' and/or Architect's liability to the extent caused by the sole negligence, active negligence, or willful misconduct of the Indemnitees, and/or defects in design furnished by the Architect, as found by a court or arbitrator of competent jurisdiction. The District shall have the right to accept or reject any legal representation that Contractor proposes to defend the Indemnitees. If any Indemnitee provides its own defense due to failure to timely respond to tender of defense, rejection of tender of defense, or conflict of interest of proposed counsel, Contractor shall reimburse such Indemnitee for any expenditures. Contractor's defense obligation shall not be construed to negate, abridge, or otherwise reduce any right or obligation of defense that would otherwise exist as to any Indemnitee or other person described herein. Contractor's defense obligation includes, but is not limited to, any failure or alleged failure by Contractor to comply with any provision of law, any failure or alleged failure to timely and properly fulfill all of its obligations under the Contract Documents in strict accordance with their terms, and without limitation, any failure or alleged failure of Contractor's obligations regarding any stop

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payment notice actions or liens, including Civil Wage and Penalty Assessments and/or Orders by the DIR. The Contractor shall give prompt notice to the District in the event of any Claim(s).

14.2.3 Without limitation of the provisions herein, if the Contractor's obligation to indemnify and hold harmless the Indemnitees or its obligation to defend Indemnitees as provided herein shall be determined to be void or unenforceable, in whole or in part, it is the intention of the parties that these circumstances shall not otherwise affect the validity or enforceability of the Contractor's agreement to indemnify, defend, and hold harmless the rest of the Indemnitees, as provided herein. Further, the Contractor shall be and remain fully liable on its agreements and obligations herein to the fullest extent permitted by law.

14.2.4 Pursuant to Public Contract Code section 9201, the District shall provide timely notification to Contractor of the receipt of any third-party claim relating to this Contract. The District shall be entitled to recover its reasonable costs incurred in providing said notification.

14.2.5 In any and all claims against any of the Indemnitees by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the Contractor's indemnification obligation herein shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the Contractor or any Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

14.2.6 The District may retain so much of the moneys due the Contractor as shall be considered necessary, until disposition of any such Claims or until the District, Architect(s) and Construction Manager(s) have received written agreement from the Contractor that they will unconditionally defend the District, Architect(s) and Construction Manager(s), their respective officers, agents and employees, and pay any damages due by reason of settlement or judgment.

14.2.7 The Contractor's defense and indemnification obligations hereunder shall survive the completion of Work, the warranty/guarantee period, and the termination of the Contract.

15. TIME

15.1 Notice to Proceed

15.1.1 District may issue a Notice to Proceed within ninety (90) days from the date of the Notice of Award. Once Contractor has received the Notice to Proceed, Contractor shall complete the Work within the period of time indicated in the Contract Documents.

15.1.2 In the event that the District desires to postpone issuing the Notice to Proceed beyond ninety (90) days from the date of the Notice of Award, it is expressly understood that with reasonable notice to the Contractor, the District may postpone issuing the Notice to Proceed. It is further expressly understood by Contractor that Contractor shall not be entitled to any claim of additional compensation as a result of the postponement of the issuance of the Notice to Proceed.

15.1.3 If the Contractor believes that a postponement of issuance of the Notice to Proceed will cause a hardship to Contractor, Contractor may terminate the Contract. Contractor's termination due to a postponement shall be by written notice to District within ten (10) days after receipt by Contractor of District's notice of postponement. It is further understood by Contractor that in the event that Contractor terminates the Contract as a result of postponement by the District, the District shall only be obligated to pay Contractor for the Work that Contractor had performed at the time of notification of postponement. Should Contractor terminate the Contract

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as a result of a notice of postponement, District shall have the authority to award the Contract to the next lowest responsive responsible bidder.

15.2 Computation of Time / Adverse Weather

15.2.1 The Contractor will only be allowed a time extension for Adverse Weather conditions if requested by Contractor in compliance with the time extension request procedures and only if all of the following conditions are met:

15.2.1.1 The weather conditions constitute Adverse Weather, as defined herein and further specified in the Special Conditions;

15.2.1.2 Contractor can verify that the Adverse Weather caused delays in excess of five (5) hours of the indicated labor required to complete the scheduled tasks of Work on the day affected by the Adverse Weather;

15.2.1.3 The Contractor's crew is dismissed as a result of the Adverse Weather;

15.2.1.4 Said delay adversely affects the critical path in the Construction Schedule; and

15.2.1.5 Exceeds sixty-three (63) days of delay per year.

15.2.2 If the aforementioned conditions are met, a non-compensable day-for-day extension will only be allowed for those days in excess of those indicated in the Special Conditions.

15.2.3 The Contractor shall work seven (7) days per week, if necessary, irrespective of inclement weather, to maintain access and the Construction Schedule, and to protect the Work under construction from the effects of Adverse Weather, all at no further cost to the District.

15.2.4 The Contract Time has been determined with consideration given to the average climate weather conditions prevailing in the County in which the Project is located.

15.3 Hours of Work

15.3.1 Sufficient Forces

Contractor and Subcontractors shall continuously furnish sufficient and competent work forces with the required levels of familiarity with the Project and skill, training and experience to ensure the prosecution of the Work in accordance with the Construction Schedule.

15.3.2 Performance During Working Hours

Work shall be performed during regular working hours as permitted by the appropriate governmental agency except that in the event of an emergency, or when required to complete the Work in accordance with job progress, Work may be performed outside of regular working hours with the advance written consent of the District and approval of any required governmental agencies.

15.3.3 No Work during Testing

Contractor shall, at no additional cost to the District and at the District's request, coordinate its Work to not disturb District students including, without limitation, not performing any Work when

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students at the Site are taking tests. The District or District's Representative will provide Contractor with a schedule of test dates concurrent with the District's issuance of the Notice to Proceed, or as soon as test dates are made available to the District.

15.4 Progress and Completion

15.4.1 Time of the Essence

Time limits stated in the Contract Documents are of the essence to the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

15.4.2 No Commencement Without Insurance or Bonds

The Contractor shall not commence operations on the Project or elsewhere prior to the effective date of insurance and bonds. The date of commencement of the Work shall not be changed by the effective date of such insurance or bonds. If Contractor commences Work without insurance and bonds, all Work is performed at Contractor's peril and shall not be compensable until and unless Contractor secures bonds and insurance pursuant to the terms of the Contract Documents and subject to District claim for damages.

15.5 Schedule

Contractor shall provide to District, Construction Manager, and Architect a schedule in conformance with the Contract Documents and as required in the Notice to Proceed and the Contractor's Submittals and Schedules section of these General Conditions.

15.6 Expeditious Completion

The Contractor shall proceed expeditiously with adequate forces and shall achieve Completion within the Contract Time.

16. EXTENSIONS OF TIME – LIQUIDATED DAMAGES

16.1 Liquidated Damages

Contractor and District hereby agree that the exact amount of damages for failure to complete the Work within the time specified is extremely difficult or impossible to determine. If the Work is not completed within the time specified in the Contract Documents, it is understood that the District will suffer damage. It being impractical and unfeasible to determine the amount of actual damage, it is agreed the Contractor shall pay to District as fixed and liquidated damages, and not as a penalty, the amount set forth in the Agreement for each calendar day of delay in completion. Contractor and its Surety shall be liable for the amount thereof pursuant to Government Code section 53069.85.

16.2 Excusable Delay

16.2.1 Contractor shall not be charged for liquidated damages because of any delays in completion of Work which are not the fault of Contractor or its Subcontractors, including acts of God as defined in Public Contract Code section 7105, acts of enemy, epidemics, and quarantine restrictions. Contractor shall, within five (5) calendar days of beginning of any delay, notify District in writing of causes of delay including documentation and facts explaining the delay and the direct correlation between the cause and effect. District shall review the facts and extent of any delay and shall grant extension(s) of time for completing Work when, in its judgment, the

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findings of fact justify an extension. Extension(s) of time shall apply only to that portion of Work affected by delay, and shall not apply to other portions of Work not so affected. An extension of time may only be granted if Contractor has timely submitted the Construction Schedule as required herein.

16.2.2 Contractor shall notify the District pursuant to the claims provisions in these General Conditions of any anticipated delay and its cause. Following submission of a claim, the District may determine whether the delay is to be considered avoidable or unavoidable, how long it continues, and to what extent the prosecution and completion of the Work might be delayed thereby.

16.2.3 In the event the Contractor requests an extension of Contract Time for unavoidable delay, such request shall be submitted in accordance with the provisions in the Contract Documents governing changes in Work. When requesting time, requests must be submitted with full justification and documentation. If the Contractor fails to submit justification, it waives its right to a time extension at a later date. Such justification must be based on the official Construction Schedule as updated at the time of occurrence of the delay or execution of Work related to any changes to the Scope of Work. Any claim for delay must include the following information as support, without limitation:

16.2.3.1 The duration of the activity relating to the changes in the Work and the resources (manpower, equipment, material, etc.) required to perform the activities within the stated duration.

16.2.3.2 Specific logical ties to the Contract Schedule for the proposed changes and/or delay showing the activity/activities in the Construction Schedule that are affected by the change and/or delay. In particular, Contractor must show an actual impact to the schedule, after making a good faith effort to mitigate the delay by rescheduling the work, by providing an analysis of the schedule ("Time Impact Analysis"). Such Time Impact Analysis shall describe in detail the cause and effect of the delay and the impact on the critical dates in the Project schedule. (A portion of any delay of seven (7) days or more must be provided.)

16.2.3.3 A recovery schedule must be submitted within twenty (20) calendar days of written notification to the District of causes of delay.

16.3 No Additional Compensation for Delays Within Contractor's Control

16.3.1 Contractor is aware that governmental agencies, including, without limitation, the Division of the State Architect, the Department of General Services, gas companies, electrical utility companies, water districts, and other agencies may have to approve Contractor-prepared drawings or approve a proposed installation. Accordingly, Contractor shall include in its bid, time for possible review of its drawings and for reasonable delays and damages that may be caused by such agencies. Thus, Contractor is not entitled to make a claim for damages or delays arising from the review of Contractor's drawings.

16.3.2 Contractor shall only be entitled to compensation for delay when all of the following conditions are met:

16.3.2.1 The District is responsible for the delay;

16.3.2.2 The delay is unreasonable under the circumstances involved;

16.3.2.3 The delay was not within the contemplation of the District and Contractor;

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16.3.2.4 The delay could not have been avoided or mitigated by Contractor's reasonable diligence; and

16.3.2.5 Contractor timely complies with the claims procedure of the Contract Documents.

16.4 Float or Slack in the Schedule

Float or slack is the amount of time between the early start date and the late start date, or the early finish date and the late finish date, of any of the activities in the schedule. Float or slack is not for the exclusive use of or benefit of either the District or the Contractor, but its use shall be determined solely by the District.

17. CHANGES IN THE WORK

17.1 No Changes Without Authorization

17.1.1 There shall be no change whatsoever in the Drawings, Specifications, or in the Work without an executed Change Order or a written Construction Change Directive authorized by the District as herein provided. District shall not be liable for the cost of any extra work or any substitutions, changes, additions, omissions, or deviations from the Drawings and Specifications unless the District's governing board has authorized the same and the cost thereof has been approved in writing by Change Order or Construction Change Directive in advance of the changed Work being performed. No extension of time for performance of the Work shall be allowed hereunder unless claim for such extension is made at the time changes in the Work are ordered, and such time duly adjusted and approved in writing in the Change Order or Construction Change Directive. Contractor shall be responsible for any costs incurred by the District for professional services and DSA fees and/or delay to the Project Schedule, if any, for DSA to review any request for changes to the DSA approved plans and specifications for the convenience of the Contractor and/or to accommodate the Contractor's means and methods. The provisions of the Contract Documents shall apply to all such changes, additions, and omissions with the same effect as if originally embodied in the Drawings and Specifications.

17.1.2 Contractor shall perform immediately all work that has been authorized by a fully executed Change Order or Construction Change Directive. Contractor shall be fully responsible for any and all delays and/or expenses caused by Contractor's failure to expeditiously perform this Work.

17.1.3 Should any Change Order result in an increase in the Contract Price or extend the Contract Time, the cost of or length of extension in that Change Order shall be agreed to, in writing, by the District in advance of the Work by Contractor, and shall be subject to the monetary limitations set forth in Public Contract Code section 20118.4. In the event that Contractor proceeds with any change in Work without a Change Order executed by the District or Construction Change Directive, Contractor waives any claim of additional compensation or time for that additional work. Under no circumstances shall Contractor be entitled to any claim of additional compensation or time not expressly requested by Contractor in a Proposed Change Order or approved by District in an executed Change Order.

17.1.4 A Change Order or Construction Change Directive will become effective when approved by the Board, notwithstanding that Contractor has not signed it. A Change Order or Construction Change Directive will become effective without Contractor's signature provided District indicates it as a "Unilateral Change Order". Any dispute as to the adjustment in the Contract Price or Contract Time, if any, of the Unilateral Change Order shall be resolved pursuant to the Payment and Claims and Disputes provisions herein.

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17.1.5 Contractor understands, acknowledges, and agrees that the reason for District authorization is so that District may have an opportunity to analyze the Work and decide whether the District shall proceed with the Change Order or alter the Project so that a change in Work becomes unnecessary.

17.2 Architect Authority

The Architect will have authority to order minor changes in the Work not involving any adjustment in the Contract Price, or an extension of the Contract Time, or a change that is inconsistent with the intent of the Contract Documents. These changes shall be effected by written Change Order, Construction Change Directive, by Architect's response(s) to RFI(s), or by Architect's Supplemental Instructions ("ASI").

17.3 Change Orders

17.3.1 A Change Order is a written instrument prepared and issued by the District and/or the Architect and signed by the District (as authorized by the District's Governing Board), the Contractor, the Architect, and approved by the Project Inspector (if necessary) and DSA (if necessary), stating their agreement regarding all of the following:

17.3.1.1 A description of a change in the Work;

17.3.1.2 The amount of the adjustment in the Contract Price, if any; and

17.3.1.3 The extent of the adjustment in the Contract Time, if any.

17.4 Construction Change Directives

17.4.1 A Construction Change Directive is a written order prepared and issued by the District, the Construction Manager, and/or the Architect and signed by the District and the Architect, directing a change in the Work. The District may, as provided by law, by Construction Change Directive and without invalidating the Contract, order changes in the Work consisting of additions, deletions, or other revisions. The adjustment to the Contract Price or Time, if any, is subject to the provisions of this section regarding Changes in the Work. If all or a portion of the Project is being funded by funds requiring approval by the State Allocation Board ("SAB"), these revisions may be subject to compensation once approval of same is received and funded by the SAB, and funds are released by the Office of Public School Construction ("OPSC"). Any dispute as to the adjustment in the Contract Price, if any, of the Construction Change Directive or timing of payment shall be resolved pursuant to the Payment and Claims and Disputes provisions herein.

17.4.2 The District may issue a Construction Change Directive in the absence of agreement on the terms of a Change Order.

17.5 Force Account Directives

17.5.1 When work, for which a definite price has not been agreed upon in advance, is to be paid for on a force account basis, all direct costs necessarily incurred and paid by the Contractor for labor, material, and equipment used in the performance of that Work, shall be subject to the approval of the District and compensation will be determined as set forth herein.

17.5.2 The District will issue a Force Account Directive to proceed with the Work on a force account basis, and a not-to-exceed budget will be established by the District.

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17.5.3 All requirements regarding direct cost for labor, labor burden, material, equipment, and markups on direct costs for overhead and profit described in this section shall apply to Force Account Directives. However, the District will only pay for actual costs verified in the field by the District or its authorized representative(s) on a daily basis.

17.5.4 The Contractor shall be responsible for all cost related to the administration of Force Account Directive. The markup for overhead and profit for Contractor modifications shall be full compensation to the Contractor to administer Force Account Directive, and Contractor shall not be entitled to separately recover additional amounts for overhead and/or profit.

17.5.5 The Contractor shall notify the District or its authorized representative(s) at least twenty-four (24) hours prior to proceeding with any of the force account work. Furthermore, the Contractor shall notify the District when it has consumed eighty percent (80%) of the budget, and shall not exceed the budget unless specifically authorized in writing by the District. The Contractor will not be compensated for force account work in the event that the Contractor fails to timely notify the District regarding the commencement of force account work, or exceeding the force account budget.

17.5.6 The Contractor shall diligently proceed with the work, and on a daily basis, submit a daily force account report on a form supplied by the District no later than 5:00 p.m. each day. The report shall contain a detailed itemization of the daily labor, material, and equipment used on the force account work only. The names of the individuals performing the force account work shall be included on the daily force account reports. The type and model of equipment shall be identified and listed. The District will review the information contained in the reports, and sign the reports no later than the next work day, and return a copy of the report to the Contractor for their records. The District will not sign, nor will the Contractor receive compensation for work the District cannot verify. The Contractor will provide a weekly force account summary indicating the status of each Force Account Directive in terms of percent complete of the not-to-exceed budget and the estimated percent complete of the work.

17.5.7 In the event the Contractor and the District reach a written agreement on a set cost for the work while the work is proceeding based on a Force Account Directive, the Contractor's signed daily force account reports shall be discontinued and all previously signed reports shall be invalid.

17.6 Price Request

17.6.1 Definition of Price Request

A Price Request ("PR") is a written request prepared by the Architect requesting the Contractor to submit to the District and the Architect an estimate of the effect of a proposed change in the Work on the Contract Price and the Contract Time.

17.6.2 Scope of Price Request

A Price Request shall contain adequate information, including any necessary Drawings and Specifications, to enable Contractor to provide the cost breakdowns required herein. The Contractor shall not be entitled to any additional compensation for preparing a response to a Price Request, whether ultimately accepted or not.

17.7 Proposed Change Order

17.7.1 Definition of Proposed Change Order

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A Proposed Change Order ("PCO") is a written request prepared by the Contractor requesting that the District and the Architect issue a Change Order based upon a proposed change to the Work.

17.7.2 Changes in Contract Price

A PCO shall include breakdowns and backup documentation pursuant to the revisions herein and sufficient, in the District's judgment, to validate any change in Contract Price. In no case shall Contractor or any of its Subcontractors be permitted to reserve rights for additional compensation for Change Order Work.

17.7.3 Changes in Time

A PCO shall also include any changes in time required to complete the Project. Any additional time requested shall not be the number of days to make the proposed change, but must be based upon the impact to the Construction Schedule as defined in the Contract Documents. The Contractor shall justify the proposed change in time by submittal of a schedule analysis that accurately shows the impact of the change on the critical path of the Construction Schedule ("Time Impact Analysis"). If Contractor fails to request a time extension in a PCO, including the Time Impact Analysis then the Contractor is thereafter precluded from requesting, and waives any right to request, additional time and/or claim a delay. In no case shall Contractor or any of its Subcontractors be permitted to reserve rights for additional time for Change Order Work. A PCO that leaves the amount of time requested blank, or states that such time requested is "to be determined", is not permitted and shall also constitute a waiver of any right to request additional time and/or claim a delay.

17.7.4 Unknown and/or Unforeseen Conditions

If there is an Allowance, then Contractor must submit a Request for Allowance Expenditure Directive, including supporting documentation as described below, to receive authorization for the release of funds from the Allowance. Allowance Expenditure Directives shall be based on Contractor's costs, without overhead and profit, for products, delivery, installation, labor, insurance, payroll, taxes, bonding and equipment rental will be included in Allowance Expenditure Directive authorizing expenditure of funds from this Allowance. No overhead and profit shall be added to the Allowance Expenditure Directive. If cost of the unforeseen condition(s) exceed the Allowance, Contractor must submit a PCO for amounts in excess of the Allowance requesting an increase in Contract Price and/or Contract Time that is based at least partially on Contractor's assertion that Contractor has encountered unknown and/or unforeseen condition(s) on the Project, then Contractor shall base the PCO on provable information that, beyond a reasonable doubt and to the District's satisfaction, demonstrates that the unknown and/or unforeseen condition(s) were actually unknown and/or unforeseen and that the condition(s) were reasonably unknown and/or unforeseen. If not, the District shall deny the PCO as unsubstantiated, and the Contractor shall complete the Project without any increase in Contract Price and/or Contract Time based on that PCO.

17.7.5 Time to Submit Proposed Change Order

Contractor shall submit its PCO within five (5) working days of the date Contractor discovers, or reasonably should have discovered, the circumstances giving rise to the PCO, unless additional time to submit a PCO is granted in writing by the District. Time is of the essence in Contractor's submission of PCOs so that the District can promptly investigate the basis for the PCO. Accordingly, if Contractor fails to submit its PCO within this timeframe, Contractor waives,

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releases, and discharges any right to assert or claim any entitlement to an adjustment of the Contract Price and/or Time based on circumstances giving rise to the PCO

17.7.6 Proposed Change Order Certification

In submitting a PCO, Contractor certifies and affirms that the cost and/or time request is submitted in good faith, that the cost and/or time request is accurate and in accordance with the provisions of the Contract Documents, and the Contractor submits the cost and/or request for extension of time recognizing the significant civil penalties and treble damages which follow from making a false claim or presenting a false claim under Government Code section 12650 et seq.

It is expressly understood that the value of the extra Work or changes expressly includes any and all of the Contractor's costs and expenses, direct and indirect, resulting from additional time required on the Project or resulting from delay to the Project including, without limitation, cumulative impacts. Contractor is not entitled to separately recover amounts for overhead or other indirect costs. Any costs, expenses, damages, or time extensions not included are deemed waived.

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17.8 Format for Proposed Change Order

17.8.1 The following format shall be used as applicable by the District and the Contractor (e.g. Change Orders, PCO's) to communicate proposed additions and deductions to the Contract, supported by attached documentation. Any spaces left blank will be deemed no change to cost or time.

	WORK PERFORMED OTHER THAN BY CONTRACTOR	ADD	DEDUCT
(a)	Material (attach suppliers' invoice or itemized quantity and unit cost plus sales tax)		
(b)	Add Labor (attach itemized hours and rates, fully encumbered)		
(c)	Add Equipment (attach suppliers' invoice)		
(d)	Subtotal		
(e)	Add overhead and profit for any and all tiers of Subcontractor , the total not to exceed ten percent (10%) of Item (d)		
(f)	Subtotal		
(g)	Add Overhead and Profit for Contractor , not to exceed five percent (5%) of Item (f)		
(h)	Subtotal		
(i)	Add Bond and Insurance , not to exceed one and a half percent (1.5%) of Item (h)		
(j)	TOTAL		
(k)	Time (zero unless indicated; "TBD" not permitted)	Calendar Days	

	WORK PERFORMED BY CONTRACTOR	ADD	DEDUCT
(l)	Material (attach itemized quantity and unit cost plus sales tax)		
(m)	Add Labor (attach itemized hours and rates, fully encumbered)		
(n)	Add Equipment (attach suppliers' invoice)		
(o)	Subtotal		
(p)	Add Overhead and Profit for Contractor , not to exceed fifteen percent (15%) of Item (d)		
(q)	Subtotal		
(r)	Add Bond and Insurance , not to exceed one and a half percent (1.5%) of Item (f)		
(s)	TOTAL		
(t)	Time (zero unless indicated; "TBD" not permitted)	Calendar Days	

17.8.2 Labor. Contractor shall be compensated for the costs of labor actually and directly utilized in the performance of the Work. Such labor costs shall be the actual cost, not to exceed prevailing wage rates in the locality of the Site and shall be in the labor classification(s) necessary for the performance of the Work, plus employer payments of payroll taxes and insurance, health and welfare, pension, vacation, apprenticeship funds, and other direct costs resulting from Federal, State, or local laws. Labor costs shall exclude costs incurred by the Contractor in preparing estimate(s) of the costs of the change in the Work, in the maintenance of records relating to the costs of the change in the Work, coordination and assembly of materials and information relating to the change in the Work or performance thereof, or the supervision and other overhead and general conditions costs associated with the change in the Work or performance thereof, including but not limited to the cost for the job superintendent.

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17.8.3 Materials. Contractor shall be compensated for the costs of materials necessarily and actually used or consumed in connection with the performance of the change in the Work. Costs of materials 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 the change in the Work, they shall be credited to the District. If materials necessarily used in the performance of the change in the Work 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. If, in the reasonable opinion of the District, the costs asserted by the Contractor for materials in connection with any change in the Work are excessive, or if the Contractor fails to provide satisfactory evidence of the actual costs of such materials from its supplier or vendor of the same, the costs of such materials and the District's obligation to pay for the same shall be limited to the then lowest wholesale price at which similar materials are available in the quantities required to perform the change in the Work. The District may elect to furnish materials for the change in the Work, in which event the Contractor shall not be compensated for the costs of furnishing such materials or any mark-up thereon.

17.8.4 Equipment. As a precondition for the District's duty to pay for Equipment rental or loading and transportation, Contractor shall provide satisfactory evidence of the actual costs of Equipment from the supplier, vendor or rental agency of same. Contractor shall be compensated for the actual cost of the necessary and direct use of Equipment in the performance of the change in the Work. Use of such Equipment in the performance of the change in the Work shall be compensated in increments of fifteen (15) minutes. Rental time for Equipment moved by its own power shall include time required to move such Equipment to the site of the Work from the nearest available rental source of the same. If 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 Equipment is used for performance of any portion of the Work other than the change in the Work. Unless prior approval in writing is obtained by the Contractor from the Architect, the Project 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. Contractor shall not be entitled to an allowance or any other compensation for Equipment or tools used in the performance of change in the Work where such Equipment or tools have a replacement value of \$500.00 or less. Equipment costs claimed by the Contractor in connection with the performance of any 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, the Project Inspector and the District, the allowable rate for the use of Equipment in connection with 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 Equipment operator), and any and all other costs incurred by the Contractor incidental to the use of such Equipment.

17.8.5 Overhead and Profit. The phrase "Overhead and Profit" shall include field and office supervisors and assistants, watchperson, use of small tools, consumable, insurance other than construction bonds and insurance required herein, general conditions costs and home office expenses.

17.9 Change Order Certification

17.9.1 All Change Orders and PCOs include the following certification by the Contractor, either in the form specifically or incorporated by this reference:

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17.9.1.1 The undersigned Contractor approves the foregoing as to the changes, if any, to the Contract Price specified for each item, and as to the extension of time allowed, if any, for completion of the entire Work as stated herein, and agrees to furnish all labor, materials, and service, and perform all work necessary to complete any additional work specified for the consideration stated herein. Submission of sums which have no basis in fact or which Contractor knows are false are at the sole risk of Contractor and may be a violation of the False Claims Act set forth under Government Code section 12650 et seq. It is understood that the changes herein to the Contract shall only be effective when approved by the governing board of the District.

17.9.1.2 It is expressly understood that the value of the extra Work or changes expressly includes any and all of the Contractor's costs and expenses, direct and indirect, resulting from additional time required on the Project or resulting from delay to the Project including, without limitation, cumulative impacts. Contractor is not entitled to separately recover amounts for overhead or other indirect costs. Any costs, expenses, damages, or time extensions not included are deemed waived.

17.9.2 Accord and Satisfaction: Contractor's execution of any Change Order shall constitute a full accord and satisfaction, and release, of all Contractor (and if applicable, Subcontractor) claims for additional time, money or other relief arising from or relating to the subject matter of the change including, without limitation, impacts of all types, cumulative impacts, inefficiency, overtime, delay and any other type of claim.

17.10 Determination of Change Order Cost

17.10.1 The amount of the increase or decrease in the Contract Price from a Change Order, if any, shall be determined in one or more of the following ways as applicable to a specific situation and at the District's discretion:

17.10.1.1 District acceptance of a PCO;

17.10.1.2 By unit prices contained in Contractor's original bid;

17.10.1.3 By agreement between District and Contractor.

17.11 Deductive Change Orders

All deductive Change Order(s) must be prepared pursuant to the provisions herein. Where a portion of the Work is deleted from the Contract, the reasonable value of the deducted work less the value of work performed shall be considered the appropriate deduction. The value submitted on the Schedule of Values shall be used to calculate the credit amount unless the bid documentation is being held in escrow as part of the Contract Documents. Unit Prices, if any, may be used in District's discretion in calculating reasonable value. If Contractor offers a proposed amount for a deductive Change Order(s), Contractor shall include a minimum of five percent (5%) total profit and overhead to be deducted with the amount of the work of the Change Order(s). If Subcontractor work is involved, Subcontractors shall also include a minimum of five percent (5%) profit and overhead to be deducted with the amount of its deducted work. Any deviation from this provision shall not be allowed.

17.12 Addition or Deletion of Alternate Bid Item(s)

If the Bid Form and Proposal includes proposal(s) for Alternate Bid Item(s), during Contractor's performance of the Work, the District may elect to add or delete any such Alternate Bid Item(s) if not included in the Contract at the time of award. If the District elects to add or delete Alternate Bid

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Item(s) after Contract award, the cost or credit for such Alternate Bid Item(s) shall be as set forth in the Bid Form and Proposal unless the parties agree to a different price and the Contract Time shall be adjusted by the number of days allocated in the Contract Documents. If days are not allocated in the Contract Documents, the Contract Time shall be equitably adjusted.

17.13 Discounts, Rebates, and Refunds

For purposes of determining the cost, if any, of any change, addition, or omission to the Work hereunder, all trade discounts, rebates, refunds, and all returns from the sale of surplus materials and equipment shall accrue and be credited to the Contractor, and the Contractor shall make provisions so that such discounts, rebates, refunds, and returns may be secured, and the amount thereof shall be allowed as a reduction of the Contractor's cost in determining the actual cost of construction for purposes of any change, addition, or omission in the Work as provided herein.

17.14 Accounting Records

With respect to portions of the Work performed by Change Orders and Construction Change Directives, the Contractor shall keep and maintain cost-accounting records satisfactory to the District, including, without limitation, Job Cost Reports as provided in these General Conditions, which shall be available to the District on the same terms as any other books and records the Contractor is required to maintain under the Contract Documents. Such records shall include without limitation hourly records for Labor and Equipment and itemized records of materials and Equipment used that day in connection with the performance of any Work. All records maintained hereunder shall be subject to inspection, review and/or reproduction by the District, the Architect or the Project Inspector upon request. In the event that the Contractor fails or refuses, for any reason, to maintain or make available for inspection, review and/or reproduction such records, the District's reasonable good faith determination of the extent of adjustment to the Contract Price shall be final, conclusive, dispositive and binding upon Contractor.

17.15 Notice Required

If the Contractor desires to make a claim for an increase in the Contract Price, or any extension in the Contract Time for completion, it shall notify the District pursuant to the provisions herein, including the Article on Claims and Disputes. No claim shall be considered unless made in accordance with this subparagraph. Contractor shall proceed to execute the Work even though the adjustment may not have been agreed upon. Any change in the Contract Price or extension of the Contract Time resulting from such claim shall be authorized by a Change Order.

17.16 Applicability to Subcontractors

Any requirements under this Article shall be equally applicable to Change Orders or Construction Change Directives issued to Subcontractors by the Contractor to the extent as required by the Contract Documents.

17.17 Alteration to Change Order Language

Contractor shall not alter Change Orders or reserve time in Change Orders. Change Orders altered in violation of this provision, if in conflict with the terms set forth herein, shall be construed in accordance with the terms set forth herein. Contractor shall execute finalized Change Orders and proceed under the provisions herein with proper notice.

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17.18 Failure of Contractor to Execute Change Order

Contractor shall be in default of the Contract if Contractor fails to execute a Change Order when the Contractor agrees with the addition and/or deletion of the Work in that Change Order.

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18. **REQUEST FOR INFORMATION**

18.1 Any Request for Information shall reference all applicable Contract Document(s), including Specification section(s), detail(s), page number(s), drawing number(s), and sheet number(s), etc. The Contractor shall make suggestions and interpretations of the issue raised by each Request for Information. A Request for Information cannot modify the Contract Price, Contract Time, or the Contract Documents. Upon request by the District, Contractor shall provide an electronic copy of the Request for Information in addition to the hard copy.

18.2 The Contractor shall be responsible for any costs incurred for professional services that District may deduct from any amounts owing to the Contractor, if a Request for Information requests an interpretation or decision of a matter where the information sought is equally available to the party making the request. District, at its sole discretion, shall deduct from and/or invoice Contractor for all the professional services arising herein.

19. **PAYMENTS**

19.1 **Contract Price**

The Contract Price is stated in the Agreement and, including authorized adjustments, is the total amount payable by the District to the Contractor for performance of the Work under the Contract Documents.

19.2 **Applications for Progress Payments**

19.2.1 **Procedure for Applications for Progress Payments**

19.2.1.1 **Application for Progress Payment**

19.2.1.1.1 Not before the fifth (5th) day of each calendar month during the progress of the Work, Contractor shall submit to the District and the Architect an itemized Application for Payment for operations completed in accordance with the Schedule of Values. Such application shall be notarized, if required, and supported by the following or each portion thereof unless waived by the District in writing:

19.2.1.1.1.1 Contractor shall submit a separate Application for Payment for each Increment (Increment 1 and Increment 2).

19.2.1.1.1.2 Contractor is required to upload Applications for Payment into a designated Project Management Information System (PMIS) as required by the District.

19.2.1.1.1.3 The amount paid to the date of the Application to the Contractor, to all its Subcontractors, and all others furnishing labor, material, or equipment for its Contract;

19.2.1.1.1.4 The amount being requested under the Application for Payment by the Contractor on its own behalf and separately stating the amount requested on behalf of each of the Subcontractors and all others furnishing labor, material, and equipment under the Contract;

19.2.1.1.1.5 The balance that will be due to each of such entities after said payment is made;

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19.2.1.1.1.6 A certification that the As-Builts and annotated Specifications are current;

19.2.1.1.1.7 Itemized breakdown of work done for the purpose of requesting partial payment;

19.2.1.1.1.8 An updated and acceptable construction schedule in conformance with the provisions herein;

19.2.1.1.1.9 The additions to and subtractions from the Contract Price and Contract Time;

19.2.1.1.1.10 A total of the retentions held;

19.2.1.1.1.11 Material invoices, evidence of equipment purchases, rentals, and other support and details of cost as the District may require from time to time;

19.2.1.1.1.12 The percentage of completion of the Contractor's Work by line item;

19.2.1.1.1.13 Schedule of Values updated from the preceding Application for Payment;

19.2.1.1.1.14 A duly completed and executed conditional waiver and release upon progress payment compliant with Civil Code section 8132 from the Contractor and each subcontractor of any tier and supplier to be paid from the current progress payment;

19.2.1.1.1.15 A duly completed and executed unconditional waiver and release upon progress payment compliant with Civil Code section 8134 from the Contractor and each subcontractor of any tier and supplier that was paid from the previous progress payment(s); and

19.2.1.1.1.16 A certification by the Contractor of the following:

The Contractor warrants title to all Work performed as of the date of this payment application has been completed in accordance with the Contract Documents for the Project. The Contractor further warrants that all amounts have been paid for work which previous Certificates for Payment were issued and payments received and all Work performed as of the date of this payment application is free and clear of liens, claims, security interests, or encumbrances in favor of the Contractor, Subcontractors, material and equipment suppliers, workers, or other persons or entities making a claim by reason of having provided labor, materials, and equipment relating to the Work, except those of which the District has been informed. Submission of sums which have no basis in fact or which Contractor knows are false are at the sole risk of Contractor and may be a violation of the False Claims Act set forth under Government Code section 12650 et seq.

19.2.1.1.1.17 The Contractor shall be subject to the False Claims Act set forth in Government Code section 12650 et seq. for information provided with any Application for Progress Payment.

19.2.1.1.1.18 All remaining certified payroll records ("CPR(s)") for each journeyman, apprentice, worker, or other employee employed by the Contractor

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and/or each Subcontractor in connection with the Work for the period of the Application for Payment. As indicated herein, the District shall not make any payment to Contractor until:

19.2.1.1.1.18.1 Contractor and/or its Subcontractor(s) provide electronic CPRs weekly for all weeks any journeyman, apprentice, worker or other employee was employed in connection with the Work directly to the DIR, or within ten (10) days of any request by the District or the DIR, and

19.2.1.1.1.18.2 Any delay in Contractor and/or its Subcontractor(s) providing CPRs in a timely manner may directly delay the Contractor's payment.

19.2.1.1.2 Applications received after June 20th will not be paid until the second week of July and applications received after December 12th will not be paid until the first week of January.

19.2.2 Prerequisites for Progress Payments

19.2.2.1 First Payment Request: The following items, if applicable, must be completed before the District will accept and/or process the Contractor's first payment request:

- 19.2.2.1.1** Installation of the Project sign;
- 19.2.2.1.2** Installation of field office;
- 19.2.2.1.3** Installation of temporary facilities and fencing;
- 19.2.2.1.4** Schedule of Values;
- 19.2.2.1.5** Contractor's Construction Schedule;
- 19.2.2.1.6** Schedule of unit prices, if applicable;
- 19.2.2.1.7** Submittal Schedule;
- 19.2.2.1.8** Receipt by Architect of all submittals due as of the date of the payment application;
- 19.2.2.1.9** Copies of necessary permits;
- 19.2.2.1.10** Copies of authorizations and licenses from governing authorities;
- 19.2.2.1.11** Initial progress report;
- 19.2.2.1.12** Surveyor qualifications;
- 19.2.2.1.13** Written acceptance of District's survey of rough grading, if applicable;
- 19.2.2.1.14** List of all Subcontractors, with names, license numbers, telephone numbers, and Scope of Work;

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19.2.2.1.15 All bonds and insurance endorsements; and

19.2.2.1.16 Resumes of Contractor's project manager, and if applicable, job site secretary, record documents recorder, and job site superintendent.

19.2.2.2 Second Payment Request: The District will not process the second payment request until and unless all submittals and Shop Drawings have been accepted for review by the Architect.

19.2.2.3 No Waiver of Criteria: Any payments made to Contractor where criteria set forth herein have not been met shall not constitute a waiver of said criteria by District. Instead, such payment shall be construed as a good faith effort by District to resolve differences so Contractor may pay its Subcontractors and suppliers. Contractor agrees that failure to submit such items may constitute a breach of contract by Contractor and may subject Contractor to termination.

19.3 Progress Payments

19.3.1 District's Approval of Application for Payment

19.3.1.1 Upon receipt of an Application for Payment, The District shall act in accordance with both of the following:

19.3.1.1.1 Each Application for Payment shall be reviewed by the District as soon as practicable after receipt for the purpose of determining that the Application for Payment is a proper Application for Payment.

19.3.1.1.2 Any Application for Payment determined not to be a proper Application for Payment suitable for payment shall be returned to the Contractor as soon as practicable, but not later than seven (7) days, after receipt. An Application for Payment returned pursuant to this paragraph shall be accompanied by a document setting forth in writing the reasons why the Application for Payment is not proper. The number of days available to the District to make a payment without incurring interest pursuant to this section shall be reduced by the number of days by which the District exceeds this seven-day return requirement.

19.3.1.1.3 An Application for Payment shall be considered properly executed if funds are available for payment of the Application for Payment, and payment is not delayed due to an audit inquiry by the financial officer of the District.

19.3.1.2 The District's review of the Contractor's Application for Payment will be based on the District's and the Architect's observations at the Site and the data comprising the Application for Payment that the Work has progressed to the point indicated and that, to the best of the District's and the Architect's knowledge, information, and belief, the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to:

19.3.1.2.1 Observation of the Work for general conformance with the Contract Documents,

19.3.1.2.2 Results of subsequent tests and inspections,

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19.3.1.2.3 Minor deviations from the Contract Documents correctable prior to completion, and

19.3.1.2.4 Specific qualifications expressed by the Architect.

19.3.1.3 District's approval of the certified Application for Payment shall be based on Contractor complying with all requirements for a fully complete and valid certified Application for Payment.

19.3.2 Payments to Contractor

19.3.2.1 Within thirty (30) days after approval of the Application for Payment, Contractor shall be paid a sum equal to ninety-five percent (95%) of the value of the Work performed (as verified by Architect and Inspector and certified by Contractor) up to the last day of the previous month, less the aggregate of previous payments and amount to be withheld. The value of the Work completed shall be Contractor's best estimate. No inaccuracy or error in said estimate shall operate to release the Contractor, or any Surety upon any bond, from damages arising from such Work, or from the District's right to enforce each and every provision of this Contract, and the District shall have the right subsequently to correct any error made in any estimate for payment.

19.3.2.2 The Contractor shall not be entitled to have any payment requests processed, or be entitled to have any payment made for Work performed, so long as any lawful or proper direction given by the District concerning the Work, or any portion thereof, remains incomplete.

19.3.2.3 If the District fails to make any progress payment within thirty (30) days after receipt of an undisputed and properly submitted Application for Payment from the Contractor, the District shall pay interest to the Contractor equivalent to the legal rate set forth in subdivision (a) of Section 685.010 of the Code of Civil Procedure.

19.3.3 No Waiver

No payment by District hereunder shall be interpreted so as to imply that District has inspected, approved, or accepted any part of the Work. Notwithstanding any payment, the District may enforce each and every provision of this Contract. The District may correct or require correction of any error subsequent to any payment.

19.4 Decisions to Withhold Payment

19.4.1 Reasons to Withhold Payment

The District may withhold payment in whole, or in part, to the extent reasonably necessary to protect the District if, in the District's opinion, the representations to the District required herein cannot be made. The District may withhold payment, in whole, or in part, to such extent as may be necessary to protect the District from loss because of, but not limited to any of the following:

19.4.1.1 Defective Work not remedied within **FORTY-EIGHT (48)** hours of written notice to Contractor.

19.4.1.2 Stop Payment Notices or other liens served upon the District as a result of the Contract. Contractor agrees that the District may withhold up to 125% of the amount claimed

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in the Stop Payment Notice to answer the claim and to provide for the District's reasonable cost of any litigation pursuant to the stop payment notice.

19.4.1.3 Liquidated damages assessed against the Contractor.

19.4.1.4 The cost of completion of the Contract if there exists a reasonable doubt that the Work can be completed for the unpaid balance of the Contract Price or by the completion date.

19.4.1.5 Damage to the District or other contractor(s).

19.4.1.6 Unsatisfactory prosecution of the Work by the Contractor.

19.4.1.7 Failure to store and properly secure materials.

19.4.1.8 Failure of the Contractor to submit, on a timely basis, proper, sufficient, and acceptable documentation required by the Contract Documents, including, without limitation, a Construction Schedule, Schedule of Submittals, Schedule of Values, Monthly Progress Schedules, Shop Drawings, Product Data and samples, Proposed product lists, executed Change Orders, and/or verified reports.

19.4.1.9 Failure of the Contractor to maintain As-Builts.

19.4.1.10 Erroneous estimates by the Contractor of the value of the Work performed, or other false statements in an Application for Payment.

19.4.1.11 Unauthorized deviations from the Contract Documents.

19.4.1.12 Failure of the Contractor to prosecute the Work in a timely manner in compliance with the Construction Schedule, established progress schedules, and/or completion dates.

19.4.1.13 Failure to provide acceptable electronic certified payroll records, as required by the Labor Code, by these Contract Documents, or by written request; for each journeyman, apprentice, worker, or other employee employed by the Contractor and/or by each Subcontractor in connection with the Work for the period of the Application for Payment or if payroll records are delinquent or inadequate.

19.4.1.14 Failure to properly pay prevailing wages as required in Labor Code section 1720 et seq., failure to comply with any other Labor Code requirements, and/or failure to comply with labor compliance monitoring and enforcement by the DIR.

19.4.1.15 Allowing an unregistered subcontractor, as described in Labor Code section 1725.5, to engage in the performance of any work under this Contract.

19.4.1.16 Failure to comply with any applicable federal statutes and regulations regarding minimum wages, withholding, payrolls and basic records, apprentice and trainee employment requirements, equal employment opportunity requirements, Copeland Act requirements, Davis-Bacon Act and related requirements, Contract Work Hours and Safety Standards Act requirements, if applicable.

19.4.1.17 Failure to properly maintain or clean up the Site.

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19.4.1.18 Failure to timely indemnify, defend, or hold harmless the District.

19.4.1.19 Any payments due to the District, including but not limited to payments for failed tests, utilities changes, or permits.

19.4.1.20 Failure to pay Subcontractor(s) or supplier(s) as required by law and by the Contract Documents.

19.4.1.21 Failure to pay any royalty, license or similar fees.

19.4.1.22 Contractor is otherwise in breach, default, or in substantial violation of any provision of this Contract.

19.4.1.23 Failure to perform any implementation and/or monitoring required by any SWPPP for the Project and/or the imposition of any penalties or fines therefore whether imposed on the District or Contractor.

19.4.2 Reallocation of Withheld Amounts

19.4.2.1 District may, in its discretion, apply any withheld amount to pay outstanding claims or obligations as defined herein. In so doing, District shall make such payments on behalf of Contractor. If any payment is so made by District, then that amount shall be considered a payment made under Contract by District to Contractor and District shall not be liable to Contractor for any payment made in good faith. These payments may be made without prior judicial determination of claim or obligation. District will render Contractor an accounting of funds disbursed on behalf of Contractor.

19.4.2.2 If Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents or fails to perform any provision thereof, District may, after **FORTY-EIGHT (48)** hours' written notice to the Contractor and, without prejudice to any other remedy, make good such deficiencies. The District shall adjust the total Contract Price by reducing the amount thereof by the cost of making good such deficiencies. If District deems it inexpedient to correct Work that is damaged, defective, or not done in accordance with Contract provisions, an equitable reduction in the Contract Price (of at least one hundred fifty percent (150%) of the estimated reasonable value of the nonconforming Work) shall be made therefor.

19.4.3 Payment After Cure

When Contractor removes the grounds for declining approval, payment shall be made for amounts withheld because of them. No interest shall be paid on any retainage or amounts withheld due to the failure of the Contractor to perform in accordance with the terms and conditions of the Contract Documents.

19.5 Subcontractor Payments

19.5.1 Payments to Subcontractors

No later than seven (7) days after receipt, or pursuant to Business and Professions Code section 7108.5 and Public Contract Code section 7107, the Contractor shall pay to each Subcontractor, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled. The Contractor shall, by appropriate

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agreement with each Subcontractor, require each Subcontractor to make payments to its Sub-subcontractors in a similar manner.

19.5.2 No Obligation of District for Subcontractor Payment

The District shall have no obligation to pay, or to see to the payment of, money to a Subcontractor except as may otherwise be required by law.

19.5.3 Joint Checks

District shall have the right in its sole discretion, if necessary for the protection of the District, to issue joint checks made payable to the Contractor and Subcontractors and/or material or equipment suppliers. The joint check payees shall be responsible for the allocation and disbursement of funds included as part of any such joint payment. In no event shall any joint check payment be construed to create any contract between the District and a Subcontractor of any tier, or a material or equipment supplier, any obligation from the District to such Subcontractor or a material or equipment supplier, or rights in such Subcontractor or a material or equipment supplier against the District.

20. COMPLETION OF THE WORK

20.1 Completion

20.1.1 District will accept completion of Contract and have the Notice of Completion recorded when the entire Work shall have been completed to the satisfaction of District.

20.1.2 The Work may only be accepted as complete by action of the governing board of the District.

20.1.3 District, at its sole option, may accept completion of Contract and have the Notice of Completion recorded when the entire Work shall have been completed to the satisfaction of District, except for minor corrective items, as distinguished from incomplete items. If Contractor fails to complete all minor corrective items within fifteen (15) days after the date of the District's acceptance of completion, District shall withhold from the final payment one hundred fifty percent (150%) of an estimate of the amount sufficient to complete the corrective items, as determined by District, until the item(s) are completed.

20.1.4 At the end of the 15-day period, if there are any items remaining to be corrected, District may elect to proceed as provided herein related to adjustments to Contract Price, and/or District's right to perform the Work of the Contractor.

20.2 Close-Out/Certification Procedures

20.2.1 Punch List

The Contractor shall notify the Architect when Contractor considers the Work complete. Upon notification, Architect will prepare a list of minor items to be completed or corrected ("Punch List"). The Contractor and/or its Subcontractors shall proceed promptly to complete and correct items on

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the Punch List. Failure to include an item on Punch List does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

20.2.2 Close-Out/Certification Requirements

20.2.2.1 Utility Connections

Buildings shall be connected to water, gas, sewer, and electric services, complete and ready for use. Service connections shall be made and existing services reconnected.

20.2.2.2 Record Drawings and Record Specifications

20.2.2.2.1 Contractor shall provide exact Record Drawings of the Work ("As-Built") and Record Specifications upon completion of the Project and as a condition precedent to approval of final payment.

20.2.2.2.2 Contractor shall obtain the Inspector's approval of the corrected prints and employ a competent draftsman to transfer the Record Drawings information to the most current version of AutoCAD that is, at that time, currently utilized for plan check submission by either the District, the Architect, OPSC, and/or DSA, and print a complete set of transparent sepias. When completed, Contractor shall deliver corrected sepias and diskette/CD/other

20.2.2.2.3 Contractor is liable and responsible for any and all inaccuracies in the Record Drawings and Record Specifications, even if inaccuracies become evident at a future date.

20.2.2.3 Maintenance Manuals: Contractor shall prepare all operation and maintenance manuals and date as indicated in the Specifications.

20.2.2.4 Source Programming: Contractor shall provide all source programming for all items in the Project.

20.2.2.5 Verified Reports: Contractor shall completely and accurately fill out and file forms DSA 6-C or DSA 152 (or current form), as appropriate. Refer to section 4-336 and section 4-343 of Part 1, Title 24 of the California Code of Regulations.

20.3 Final Inspection

20.3.1 Contractor shall comply with Punch List procedures as provided herein, and maintain the presence of a Project Superintendent and Project Manager until the Punch List is complete to ensure proper and timely completion of the Punch List. Under no circumstances shall Contractor demobilize its forces prior to completion of the Punch List without District's prior written approval. Upon receipt of Contractor's written notice that all of the Punch List items have been fully completed and the Work is ready for final inspection and District acceptance, Architect and Project Inspector will inspect the Work and shall submit to Contractor and District a final inspection report noting the Work, if any, required in order to complete in accordance with the Contract Documents. Absent unusual circumstances, this report shall consist of the Punch List items not yet satisfactorily completed.

20.3.2 Upon Contractor's completion of all items on the Punch List and any other uncompleted portions of the Work, the Contractor shall notify the District and Architect, who shall again inspect such Work. If the Architect finds the Work complete and acceptable under the

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Contract Documents, the Architect will notify Contractor, who shall then jointly submit to the Architect and the District its final Application for Payment.

20.3.3 Final Inspection Requirements

20.3.3.1 Before calling for final inspection, Contractor shall determine that the following have been performed:

20.3.3.1.1 The Work has been completed.

20.3.3.1.2 All life safety items are completed and in working order.

20.3.3.1.3 Mechanical and electrical Work are complete and tested, fixtures are in place, connected, and ready for tryout.

20.3.3.1.4 Electrical circuits scheduled in panels and disconnect switches labeled.

20.3.3.1.5 Painting and special finishes complete.

20.3.3.1.6 Doors complete with hardware, cleaned of protective film, relieved of sticking or binding, and in working order.

20.3.3.1.7 Tops and bottoms of doors sealed.

20.3.3.1.8 Floors waxed and polished as specified.

20.3.3.1.9 Broken glass replaced and glass cleaned.

20.3.3.1.10 Grounds cleared of Contractor's equipment, raked clean of debris, and trash removed from Site.

20.3.3.1.11 Work cleaned, free of stains, scratches, and other foreign matter, and damaged and broken material replaced.

20.3.3.1.12 Finished and decorative work shall have marks, dirt, and superfluous labels removed.

20.3.3.1.13 Final cleanup, as provided herein.

20.4 Costs of Multiple Inspections

More than two (2) requests of the District to make a final inspection shall be considered an additional service of District, Architect, Construction Manager, and/or Project Inspector, and all subsequent costs will be invoiced to Contractor and if funds are available, withheld from remaining payments.

20.5 Partial Occupancy or Use Prior to Completion

20.5.1 District's Rights to Occupancy

The District may occupy or use any completed or partially completed portion of the Work at any stage, and such occupancy shall not constitute the District's Final Acceptance of any part of the Work. Neither the District's Final Acceptance, the making of Final Payment, any provision in

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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. In the event that the District occupies or uses any completed or partially completed portion of the Work, the Contractor shall remain responsible for payments, security, maintenance, heat, utilities, damage to the Work, insurance, the period for correction of the Work, and the commencement of warranties required by the Contract Documents unless the Contractor requests in writing, and the District agrees, to otherwise divide those responsibilities. Any dispute as to responsibilities shall be resolved pursuant to the Claims and Disputes provisions herein, with the added provision that during the dispute process, the District shall have the right to occupy or use any portion of the Work that it needs or desires to use.

20.5.2 Inspection Prior to Occupancy or Use

Immediately prior to partial occupancy or use, the District, the Contractor, and the Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

20.5.3 No Waiver

Unless otherwise agreed upon, partial or entire occupancy or use of a portion or portions of the Work shall not constitute beneficial occupancy or District's acceptance of the Work not complying with the requirements of the Contract Documents.

21. FINAL PAYMENT AND RETENTION

21.1 Final Payment

Upon receipt and approval of a valid and final Application for Payment, the Architect will issue a final Certificate of Payment. The District shall thereupon jointly inspect the Work and either accept the Work as complete or notify the Architect and the Contractor in writing of reasons why the Work is not complete. Upon District's acceptance of the Work of the Contractor as fully complete by the Governing Board of the District (that, absent unusual circumstances, will occur when the Punch List items have been satisfactorily completed), the District shall record a Notice of Completion with the County Recorder, and the Contractor shall, upon receipt of final payment from the District, pay the amount due Subcontractors.

21.2 Prerequisites for Final Payment

The following conditions must be fulfilled prior to Final Payment:

21.2.1 A full release of all Stop Payment Notices served in connection with the Work shall be submitted by Contractor.

21.2.2 A duly completed and executed conditional waiver and release upon final payment compliant with Civil Code section 8136, from the Contractor and each subcontractor of any tier and supplier to be paid from the final payment.

21.2.3 A duly completed and executed unconditional waiver and release upon progress payment compliant with Civil Code section 8134, from the Contractor and each subcontractor of any tier and supplier that was paid from the previous progress payments.

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21.2.4 A duly completed and executed Document 00 65 19.26, "AGREEMENT AND RELEASE OF ANY AND ALL CLAIMS" from the Contractor.

21.2.5 The Contractor shall have made all corrections to the Work that are required to remedy any defects therein, to obtain compliance with the Contract Documents or any requirements of applicable codes and ordinances, or to fulfill any of the orders or directions of District required under the Contract Documents.

21.2.6 Each Subcontractor shall have delivered to the Contractor all written guarantees, warranties, applications, and bonds required by the Contract Documents for its portion of the Work.

21.2.7 Contractor must have completed all requirements set forth under "Close-Out/Certification Procedures," including, without limitation, submission of an approved set of complete Record Drawings.

21.2.8 Architect shall have issued its written approval that final payment can be made.

21.2.9 The Contractor shall have delivered to the District all manuals and materials required by the Contract Documents, which must be approved by the District.

21.2.10 The Contractor shall have completed final clean-up as provided herein.

21.3 Retention

21.3.1 The retention, less any amounts disputed by the District or that the District has the right to withhold pursuant to provisions herein, shall be paid:

21.3.1.1 After approval by the Architect of the Application and Certificate of Payment,

21.3.1.2 After the satisfaction of the conditions set forth herein, and

21.3.1.3 After forty-five (45) days after the recording of the Notice of Completion by District.

21.3.2 No interest shall be paid on any retention, or on any amounts withheld due to a failure of the Contractor to perform, in accordance with the terms and conditions of the Contract Documents, except as provided to the contrary in any Escrow Agreement between the District and the Contractor pursuant to Public Contract Code section 22300.

21.4 Substitution of Securities

The District will permit the substitution of securities in accordance with the provisions of Public Contract Code section 22300.

22. UNCOVERING OF WORK

If a portion of the Work is covered without Inspector or Architect approval or not in compliance with the Contract Documents, it must, if required in writing by the District, the Project Inspector, or the Architect, be uncovered for the Project Inspector's or the Architect's observation and be corrected, replaced, and/or recovered at the Contractor's expense without change in the Contract Price or Contract Time.

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23. **NONCONFORMING WORK AND CORRECTION OF WORK**

23.1 **Nonconforming Work**

23.1.1 Contractor shall promptly remove from Premises all Work identified by District as failing to conform to the Contract Documents whether incorporated or not. Contractor shall promptly replace and re-execute its own Work to comply with the Contract Documents without additional expense to the District and shall bear the expense of making good all work of other contractors destroyed or damaged by any removal or replacement pursuant hereto and/or any delays to the District or other Contractors caused thereby.

23.1.2 If Contractor does not remove Work that District has identified as failing to conform to the Contract Documents within a reasonable time, not to exceed **FORTY-EIGHT (48)** hours, District may remove it and may store any material at Contractor's expense. If Contractor does not pay expense(s) of that removal within ten (10) days' time thereafter, District may, upon ten (10) days' written notice, sell any material at auction or at private sale and shall deduct all costs and expenses incurred by the District and/or District may withhold those amounts from payment(s) to Contractor.

23.2 **Correction of Work**

23.2.1 **Correction of Rejected Work**

Pursuant to the notice provisions herein, the Contractor shall immediately correct the Work rejected by the District, the Architect, or the Project Inspector as failing to conform to the requirements of the Contract Documents, whether observed before or after Completion and whether or not fabricated, installed, or completed. The Contractor shall bear costs of correcting the rejected Work, including additional testing, inspections, and compensation for the Inspector's or the Architect's services and expenses made necessary thereby.

23.2.2 **Two-Year Warranty Corrections**

If, within two (2) years after the date of Completion of the Work or a designated portion thereof, or after the date for commencement of warranties established hereunder, or by the terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the District to do so. This period of two (2) years shall be extended with respect to portions of the Work first performed after Completion by the period of time between Completion and the actual performance of the Work. This obligation hereunder shall survive District's acceptance of the Work under the Contract and termination of the Contract. The District shall give such notice promptly after discovery of the condition.

23.3 **District's Right to Perform Work**

23.3.1 If the Contractor should neglect to prosecute the Work properly or fail to perform any provisions of this contract, the District, after **FORTY-EIGHT (48)** hours written notice to the Contractor, may, without prejudice to any other remedy it may have, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor.

23.3.2 If it is found at any time, before or after completion of the Work, that Contractor has varied from the Drawings and/or Specifications, including, but not limited to, variation in material, quality, form, or finish, or in the amount or value of the materials and labor used, District may require at its option:

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23.3.2.1 That all such improper Work be removed, remade or replaced, and all work disturbed by these changes be made good by Contractor at no additional cost to the District;

23.3.2.2 That the District deduct from any amount due Contractor the sum of money equivalent to the difference in value between the work performed and that called for by the Drawings and Specifications; or

23.3.2.3 That the District exercise any other remedy it may have at law or under the Contract Documents, including but not limited to the District hiring its own forces or another contractor to replace the Contractor's nonconforming Work, in which case the District shall either issue a deductive Change Order, a Construction Change Directive, or invoice the Contractor for the cost of that work. Contractor shall pay any invoices within thirty (30) days of receipt of same or District may withhold those amounts from payment(s) to Contractor.

24. TERMINATION AND SUSPENSION

24.1 District's Request for Assurances

If District at any time reasonably believes Contractor is or may be in default under this Contract, District may in its sole discretion notify Contractor of this fact and request written assurances from Contractor of performance of Work and a written plan from Contractor to remedy any potential default under the terms this Contract that the District may advise Contractor of in writing. Contractor shall, within ten (10) calendar days of District's request, deliver a written cure plan that meets the District's requirements in its request for assurances. Contractor's failure to provide such written assurances of performance and the required written plan, within ten (10) calendar days of request, will constitute a material breach of this Contract sufficient to justify termination for cause.

24.2 District's Right to Terminate Contractor for Cause

24.2.1 Grounds for Termination: The District, in its sole discretion, may terminate the Contract and/or terminate the Contractor's right to perform the work of the Contract based upon any of the following:

24.2.1.1 Contractor refuses or fails to execute the Work or any separable part thereof with sufficient diligence as will ensure its completion within the time specified or any extension thereof, or

24.2.1.2 Contractor fails to complete said Work within the time specified or any extension thereof, or

24.2.1.3 Contractor persistently fails or refuses to perform Work or provide material of sufficient quality as to be in compliance with Contract Documents; or

24.2.1.4 Contractor persistently refuses, or repeatedly fails, except in cases for which extension of time is provided, to supply enough properly skilled workers or proper materials to complete the Work in the time specified; or

24.2.1.5 Contractor fails to make prompt payment to Subcontractors, or for material, or for labor; or

24.2.1.6 Contractor persistently disregards laws, or ordinances, or instructions of District; or

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24.2.1.7 Contractor fails to supply labor, including that of Subcontractors, that is sufficient to prosecute the Work or that can work in harmony with all other elements of labor employed or to be employed on the Work; or

24.2.1.8 Contractor or its Subcontractor(s) is/are otherwise in breach, default, or in substantial violation of any provision of this Contract, including but not limited to a lapse in licensing or registration.

24.2.2 Notification of Termination

24.2.2.1 Upon the occurrence at District's sole determination of any of the above conditions, District may, without prejudice to any other right or remedy, serve written notice upon Contractor and its Surety of District's termination of this Contract and/or the Contractor's right to perform the work of the Contract. This notice will contain the reasons for termination. Unless, within three (3) days after the service of the notice, any and all condition(s) shall cease, and any and all violation(s) shall cease, or arrangement satisfactory to District for the correction of the condition(s) and/or violation(s) be made, this Contract and/or the Contractor's right to perform the Work of the Contract shall cease and terminate. Upon termination, Contractor shall not be entitled to receive any further payment until the entire Work is finished.

24.2.2.2 Upon Termination, District may immediately serve written notice of tender upon Surety whereby Surety shall have the right to take over and perform this Contract only if Surety:

24.2.2.2.1 Within three (3) days after service upon it of the notice of tender, gives District written notice of Surety's intention to take over and perform this Contract; and

24.2.2.2.2 Commences performance of this Contract within three (3) days from date of serving of its notice to District.

24.2.2.3 Surety shall not utilize Contractor in completing the Project if the District notifies Surety of the District's objection to Contractor's further participation in the completion of the Project. Surety expressly agrees that any contractor which Surety proposes to fulfill Surety's obligations is subject to District's approval. District's approval shall not be unreasonably withheld, conditioned or delayed.

24.2.2.4 If Surety fails to notify District or begin performance as indicated herein, District may take over the Work and execute the Work to completion by any method it may deem advisable at the expense of Contractor and/or its Surety. Contractor and/or its Surety shall be liable to District for any excess cost or other damages the District incurs thereby. Time is of the essence in this Contract. If the District takes over the Work as herein provided, District may, without liability for so doing, take possession of and utilize in completing the Work such materials, appliances, plan, and other property belonging to Contractor as may be on the Site of the Work, in bonded storage, or previously paid for.

24.3 Termination of Contractor for Convenience

24.3.1 District in its sole discretion may terminate the Contract in whole or in part upon three (3) days' written notice to the Contractor.

24.3.2 Upon notice, Contractor shall:

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24.3.2.1 Cease operations as directed by the District in the notice;

24.3.2.2 Take necessary actions for the protection and preservation of the Work as soon as possible; and

24.3.2.3 Terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

24.3.3 Within 30 days of the notice, Contractor submit to the District a payment application for the actual cost for labor, materials, and services performed, including all Contractor's and Subcontractor(s)' mobilization and/or demobilization costs, that is unpaid. Contractor shall have no claims against the District except for the actual cost for labor, materials, and services performed that adequately documented through timesheets, invoices, receipts, or otherwise. District shall pay all undisputed invoice(s) for work performed until the notice of termination.

24.3.4 Under a termination for convenience, the District retains the right to all the options available to the District if there is a termination for cause.

24.4 **Effect of Termination**

24.4.1 Contractor shall, only if ordered to do so by the District, immediately remove from the Site all or any materials and personal property belonging to Contractor that have not been incorporated in the construction of the Work, or which are not in place in the Work. The District retains the right, but not the obligation, to keep and use any materials and personal property belonging to Contractor that have not been incorporated in the construction of the Work, or which are not in place in the Work. The Contractor and its Surety shall be liable upon the Performance Bond for all damages caused to the District by reason of the Contractor's failure to complete the Contract.

24.4.2 In the event that the District shall perform any portion of, or the whole of the Work, pursuant to the provisions of the General Conditions, the District shall not be liable nor account to the Contractor in any way for the time within which, or the manner in which, the Work is performed by the District or for any changes the District may make in the Work or for the money expended by the District in satisfying claims and/or suits and/or other obligations in connection with the Work.

24.4.3 In the event termination for cause is determined to have not been for cause, the termination shall be deemed to have been a termination for convenience effective as of the same date as the purported termination for cause.

24.4.4 In the event that the Contract is terminated for any reason, no allowances or compensation will be granted for the loss of any anticipated profit by the Contractor or any impact or impairment of Contractor's bonding capacity.

24.4.5 If the expense to the District to finish the Work exceeds the unpaid Contract Price, Contractor and Surety shall pay difference to District within twenty-one (21) days of District's request.

24.4.6 The District shall have the right (but shall have no obligation) to assume and/or assign to a general contractor or construction manager or other third party who is qualified and has sufficient resources to complete the Work, the rights of the Contractor under its subcontracts with any or all Subcontractors. In the event of an assumption or assignment by the District, no Subcontractor shall have any claim against the District or third party for Work performed by

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Subcontractor or other matters arising prior to termination of the Contract. The District or any third party, as the case may be, shall be liable only for obligations to the Subcontractor arising after assumption or assignment. Should the District so elect, the Contractor shall execute and deliver all documents and take all steps, including the legal assignment of its contractual rights, as the District may require, for the purpose of fully vesting in the District the rights and benefits of its Subcontractor under Subcontracts or other obligations or commitments. All payments due the Contractor hereunder shall be subject to a right of offset by the District for expenses and damages suffered by the District as a result of any default, acts, or omissions of the Contractor. Contractor must include this assignment provision in all of its contracts with its Subcontractors.

24.4.7 The foregoing provisions are in addition to and not in limitation of any other rights or remedies available to District.

24.5 Emergency Termination of Public Contracts Act of 1949

24.5.1 This Contract is subject to termination as provided by sections 4410 and 4411 of the Government Code of the State of California, being a portion of the Emergency Termination of Public Contracts Act of 1949.

24.5.1.1 Section 4410 of the Government Code states:

In the event a national emergency occurs, and public work, being performed by contract, is stopped, directly or indirectly, because of the freezing or diversion of materials, equipment or labor, as the result of an order or a proclamation of the President of the United States, or of an order of any federal authority, and the circumstances or conditions are such that it is impracticable within a reasonable time to proceed with a substantial portion of the work, then the public agency and the contractor may, by written agreement, terminate said contract.

24.5.1.2 Section 4411 of the Government Code states:

Such an agreement shall include the terms and conditions of the termination of the contract and provision for the payment of compensation or money, if any, which either party shall pay to the other or any other person, under the facts and circumstances in the case.

24.5.2 Compensation to the Contractor shall be determined at the sole discretion of District on the basis of the reasonable value of the Work done, including preparatory work. As an exception to the foregoing and at the District's discretion, in the case of any fully completed separate item or portion of the Work for which there is a separate previously submitted unit price or item on the accepted schedule of values, that price shall control. The District, at its sole discretion, may adopt the Contract Price as the reasonable value of the work done or any portion thereof.

24.6 Suspension of Work

24.6.1 District in its sole discretion may suspend, delay or interrupt the Work in whole or in part for such period of time as the District may determine upon three (3) days written notice to the Contractor.

24.6.1.1 An adjustment may be made for changes in the cost of performance of the Work caused by any such suspension, delay or interruption. No adjustment shall be made to the extent:

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24.6.1.1.1 That performance is, was or would have been so suspended, delayed or interrupted by another cause for which Contractor is responsible; or

24.6.1.1.2 That an equitable adjustment is made or denied under another provision of the Contract; or

24.6.1.1.3 That the suspension of Work was the direct or indirect result of Contractor's failure to perform any of its obligations hereunder.

24.6.1.2 Any adjustments in cost of performance may have a fixed or percentage fee as provided in the section on Format for Proposed Change Order herein. This amount shall be full compensation for all Contractor's and its Subcontractor(s)' changes in the cost of performance of the Contract caused by any such suspension, delay or interruption.

25. CLAIMS PROCESS

25.1 Obligation to File Claims for Disputed Work

25.1.1 Should Contractor otherwise seek extra time or compensation for any reason whatsoever ("Disputed Work"), then Contractor shall first follow procedures set forth in the Contract Documents including, without limitation, Articles 15, 16 and 17. A Notice of Potential Change or Proposed Change Order are less formal procedures that proceed the formal claim and do not constitute a Claim. A Claim also does not include correspondence, RFIs, vouchers, invoices, progress payment applications, or other routine or authorized form of requests for progress payments in compliance with the Contract. If a dispute remains, then Contractor shall give written notice to Owner that expressly invokes this Article 25 within the time limits set forth herein.

25.1.2 Contractor's sole and exclusive remedy for Disputed Work is to file a written claim setting forth Contractor's position as required herein within the time limits set forth herein.

25.2 Duty to Perform during during Claims Process

Contractor and its subcontractors shall continue to perform its Work under the Contract including the disputed work, and shall not cause a delay of the Work during any dispute, claim, negotiation, mediation, or arbitration proceeding, except by written agreement by the District.

25.3 Definition of a Claim

25.3.1 Pursuant to Public Contract Code section 9204, the term "Claim" means a separate demand by the Contractor, sent by registered mail or certified mail with return receipt requested, for one or more of the following:

25.3.1.1 A time extension, including without limitation, for relief of damages or penalties for delay assessed by the District under the Contract;

25.3.1.2 Payment by the District of money or damages arising from work done by, or on behalf of, the Contractor pursuant to the Contract and payment of which is not otherwise expressly provided for or to which Contractor is not otherwise entitled to; or

25.3.1.3 An amount of payment disputed by the District.

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25.4 Claims Presentation

25.4.1 Form and Contents of Claim

25.4.1.1 If Contractor intends to apply for an increase in the Contract Price or Contract Time for any reason including, without limitation, the acts of District or its agents, Contractor shall, within thirty (30) days after the event giving rise to the Claim, give notice of the Claim in writing specifically identifying Contractor is invoking this Article 25 Claims Presentation.

25.4.1.2 The Claim shall include an itemized statement of the details and amounts of its Claim for any increase in the Contract Price of Contract Time as provided below, including a Time Impact Analysis and any and all other documentation substantiating Contractor's claimed damages:

25.4.1.2.1 The issues, events, conditions, circumstances and/or causes giving rise to the dispute, and shall show, in detail, the cause and effect of same;

25.4.1.2.2 Citation to provisions in the Contract Documents, statute sections, and/or case law entitling Contractor to an increase in the Contract Price or Contract Time;

25.4.1.2.3 The pertinent dates and/or durations and actual and/or anticipated effects on the Contract Price, Contract Schedule milestones and/or Contract Time adjustments;

25.4.1.2.4 The Time Impact Analysis of all time delays that shows actual time impact on the critical path; and

25.4.1.2.5 The line-item costs for labor, material, and/or equipment, if applicable, for all cost impacts priced like a change order according to Article 17 and must be updated monthly as to cost and entitlement if a continuing claim.

25.4.1.3 The Claim shall include the following certification by the Contractor:

25.4.1.3.1 The undersigned Contractor certifies under penalty of perjury that the attached dispute is made in good faith; that the supporting data is accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the adjustment for which Contractor believes the District is liable; and that I am duly authorized to certify the dispute on behalf of the Contractor.

25.4.1.3.2 Furthermore, Contractor understands that the value of the attached dispute expressly includes any and all of the Contractor's costs and expenses, direct and indirect, resulting from the Work performed on the Project, additional time required on the Project and/or resulting from delay to the Project including, without limitation, cumulative impacts. Contractor may not separately recover for overhead or other indirect costs. Any costs, expenses, damages, or time extensions not included are deemed waived.

25.4.2 Contractor shall bear all costs incurred in the preparation and submission of a claim.

25.4.3 Failure to timely submit a claim and the requisite supporting documentation shall constitute a waiver of Contractor's claim(s) against the District and Contractor's claims for compensation or an extension of time shall be forfeited and invalidated.

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25.5 Claim Resolution pursuant to Public Contract Code section 9204

Contractor may request to waive the claims procedure under Public Contract Code section 9204 and proceed directly to the commencement of a civil action or binding arbitration. If Contractor chooses to proceed, Contractor shall comply with the following steps.

25.5.1 STEP 1:

25.5.1.1 Upon receipt of a Claim by registered or certified mail, return receipt requested, including the documents necessary to substantiate it, the District shall conduct a reasonable review of the Claim and, within a period **not to exceed 45 days**, shall provide the Contractor a written statement identifying what portion of the Claim is disputed and what portion is undisputed. Upon receipt of a Claim, the District and Contractor may, **by mutual agreement, extend the time period** to provide a written statement. If the District needs approval from its governing body to provide the Contractor a written statement identifying the disputed portion and the undisputed portion of the Claim, and the governing body does not meet within the 45 days or within the mutually agreed to extension of time following receipt of Claim sent by registered mail or certified mail, return receipt requested, the District shall have **up to three (3) days following the next duly publicly noticed meeting of the governing body after the 45-day period, or extension**, expires to provide Contractor a written statement identifying the disputed portion and the undisputed portion.

25.5.1.1.1 Any payment due on an undisputed portion of the Claim shall be processed and made within 60 days after the District issues its written statement. Amounts not paid in a timely manner as required by this section, section 25.4, shall bear interest at seven percent (7%) per annum.

25.5.1.2 Upon receipt of a Claim, the parties may mutually agree to waive, in writing, mediation and proceed directly to the commencement of a civil action or binding arbitration, as applicable. In this instance, District and Contractor must comply with the sections below regarding Public Contract Code section 20104 et seq. and Government Code Claim Act Claims.

25.5.1.3 If the District fails to issue a written statement, or to otherwise meet the time requirements of this section, this shall result in the Claim being deemed rejected in its entirety. A claim that is denied by reason of the District's failure to have responded to a claim, or its failure to otherwise meet the time requirements of this section, shall not constitute an adverse finding with regard to the merits of the claim or the responsibility or qualifications of Contractor.

25.5.2 STEP 2:

25.5.2.1 If Contractor disputes the District's written response, or if the District fails to respond to a Claim within the time prescribed, Contractor may demand in writing an informal conference to meet and confer for settlement of the issues in dispute. Upon receipt of a demand in writing sent by registered mail or certified mail, return receipt requested, the District shall schedule a meet and confer conference within 30 days for settlement of the dispute. Within 10 business days following the conclusion of the meet and confer conference, if the claim or any portion of the claim remains in dispute, the District shall provide the Contractor a written statement identifying the portion of the claim that remains in dispute and the portion that is undisputed.

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25.5.2.1.1.1 Any payment due on an undisputed portion of the claim shall be processed and made within 60 days after the District issues its written statement. Amounts not paid in a timely manner as required by this section, section 25.4, shall bear interest at seven percent (7%) per annum.

25.5.3 STEP 3:

25.5.3.1 Any disputed portion of the claim, as identified by Contractor in writing, shall be submitted to nonbinding mediation, with the District and Contractor sharing the associated costs equally. The District and Contractor shall mutually agree to a mediator within 10 business days after the disputed portion of the claim has been identified in writing. If the parties cannot agree upon a mediator, each party shall select a mediator and those mediators shall select a qualified neutral third party to mediate with regard to the disputed portion of the claim. Each party shall bear the fees and costs charged by its respective mediator in connection with the selection of the neutral mediator. If mediation is unsuccessful, the parts of the claim remaining in dispute shall be subject to applicable procedures outside this section.

25.5.3.1.1 For purposes of this section, 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 parties in dispute resolution through negotiation or by issuance of an evaluation. Any mediation utilized shall conform to the timeframes in this section.

25.5.3.2 Unless otherwise agreed to by the District and Contractor in writing, the mediation conducted pursuant to this section shall excuse any further obligation under Public Contract Code section 20104.4 to mediate after litigation has been commenced.

25.5.4 STEP 4:

25.5.4.1 If mediation under this section does not resolve the parties' dispute, the District may, but does not require arbitration of disputes under private arbitration or the Public Works Contract Arbitration Program.

25.6 Subcontractor Pass-Through Claims

25.6.1 If a subcontractor or a lower tier subcontractor lacks legal standing to assert a claim against a District because privity of contract does not exist, the contractor may present to the District a Claim on behalf of a subcontractor or lower tier subcontractor. A subcontractor may request in writing, either on his or her own behalf or on behalf of a lower tier subcontractor, that Contractor present a Claim for work which was performed by the subcontractor or by a lower tier subcontractor on behalf of the subcontractor. The subcontractor requesting that the Claim be presented to the District shall furnish reasonable documentation to support the Claim.

25.6.2 Within 45 days of receipt of this written request from a subcontractor, Contractor shall notify the subcontractor in writing as to whether the Contractor presented the Claim to the District and, if Contractor did not present the Claim, provide the subcontractor with a statement of the reasons for not having done so.

25.6.3 The Contractor shall bind all its Subcontractors to the provisions of this section and will hold the District harmless against Claims by Subcontractors.

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25.7 Government Code Claim Act Claim

25.7.1 If a claim, or any portion thereof, remains in dispute upon satisfaction of all applicable Claim Resolution requirements the Contractor shall comply with all claims presentation requirements as provided in Chapter 1 (commencing with section 900) and Chapter 2 (commencing with section 910) of Part 3 of Division 3.6 of Title 1 of Government Code as a condition precedent to the Contractor's right to bring a civil action against the District.

25.7.2 Contractor shall bear all costs incurred in the preparation, submission and administration of a Claim. Any claims presented in accordance with the Government Code must affirmatively indicate Contractor's prior compliance with the claims procedure herein of the claims asserted.

25.7.3 For purposes of those provisions, the running of the time within which a claim pursuant to Public Contract Code section 20104.2 only must be presented to the District shall be tolled from the time the claimant submits his or her written claim pursuant to subdivision (a) until the time that claim is denied as a result of the meet and confer process, including any period of time utilized by the meet and confer process.

25.8 Claim Resolution pursuant to Public Contract Code section 20104 et seq.

25.8.1 In the event of a disagreement between the parties as to performance of the Work, the interpretation of this Contract, or payment or nonpayment for Work performed or not performed, the parties shall attempt to resolve all Claims of three hundred seventy-five thousand dollars (\$375,000) or less which arise between Contractor and District by those procedures set forth in Public Contract Code section 20104, et seq., to the extent applicable.

25.8.1.1 Contractor shall file with the District any written Claim, including the documents necessary to substantiate it, upon the application for final payment.

25.8.1.2 For claims of less than fifty thousand dollars (\$50,000), the District shall respond in writing within forty-five (45) days of receipt of the Claim or may request in writing within thirty (30) days of receipt of the Claim any additional documentation supporting the claim or relating to defenses or claims the District may have against the Contractor.

25.8.1.2.1 If additional information is required, it shall be requested and provided by mutual agreement of the parties.

25.8.1.2.2 District's written response to the documented Claim shall be submitted to the Contractor within fifteen (15) days after receipt of the further documentation or within a period of time no greater than that taken by the Contractor to produce the additional information, whichever is greater.

25.8.1.3 For claims of over fifty thousand dollars (\$50,000) and less than or equal to three hundred seventy-five thousand dollars (\$375,000), the District shall respond in writing to all written Claims within sixty (60) days of receipt of the claim, or may request, in writing, within thirty (30) days of receipt of the Claim any additional documentation supporting the Claim or relating to defenses or claims the District may have against the Contractor.

25.8.1.3.1 If additional information is required, it shall be requested and provided upon mutual agreement of the District and the Contractor.

END OF SECTION

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SECTION 00 73 13 - SPECIAL CONDITIONS

THIS DOCUMENT MUST BE ADAPTED FOR EACH PROJECT – Delete any provision that is not applicable or if no change from the provision in the General Conditions.

*** THIS LIST OF SPECIAL CONDITION PROVISIONS IS FOR REFERENCE ONLY. REMOVE THIS PAGE BEFORE USING THIS DOCUMENT. ***

1. Mitigation Measures
2. Modernization Projects
3. Badge Policy for Contractors
4. Substitution for Specified Items
5. Weather Days
6. Insurance Policy Limits
7. Permits, Certificates, Licenses, Fees, Approval
8. Project Labor Agreement/Payroll Records
9. As-Builts and Record Drawings
10. Construction Manager
11. Program Manager
12. Federal Funds
13. Project Management Information System (PMIS)
14. Preliminary Schedule of Values
27. Federal Labor, Wage & Labor, Apprentice, and Related Provisions

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SECTION 00 73 13 - SPECIAL CONDITIONS

1. **Mitigation Measures**

Contractor shall comply with all applicable mitigation measures, if any, adopted by any public agency with respect to this Project pursuant to the California Environmental Quality Act (CEQA). (Public Resources Code section 21000 *et seq.*)

See Appendix A for the Mitigation Monitoring and Reporting Program (MMRP) for the Merritt College Landscape Horticulture Complex Project. The General Contractor shall review and be familiar with the MMRP. The mitigation measures that are the responsibility of the contractor to implement and monitor include but are not limited to:

- (A) Biology: BIO-1
- (B) Hazards and Hazardous Materials: HAZARDS-1
- (C) Noise: NOISE-1a; NOISE-1c; NOISE-1d

2. **Modernization Projects**

2.1 Access. Access to the school buildings and entry to buildings, classrooms, restrooms, mechanical rooms, electrical rooms, or other rooms, for construction purposes, must be coordinated with District and onsite District personnel before Work is to start. Unless agreed to otherwise in writing, only a school custodian will be allowed to unlock and lock doors in existing building(s). The custodian will be available only while school is in session. If a custodian is required to arrive before 7:00 a.m. or leave after 3:30 p.m. to accommodate Contractor's Work, the overtime wages for the custodian will be paid by the Contractor, unless at the discretion of the District, other arrangements are made in advance.

2.2 Keys. Upon request, the District may, at its own discretion, provide keys to the school site for the convenience of the Contractor. The Contractor agrees to pay all expenses to re-key the entire school site and all other affected District buildings if the keys are lost or stolen, or if any unauthorized party obtains a copy of a key or access to the school.

2.3 Maintaining Services. The Contractor is advised that Work is to be performed in spaces regularly scheduled for instruction. Interruption and/or periods of shutdown of public access, electrical service, water service, lighting, or other utilities shall be only as arranged in advance with the District. Contractor shall provide temporary services to all facilities interrupted by Contractor's Work.

2.4 Maintaining Utilities. The Contractor shall maintain in operation during duration of Contract, drainage lines, storm drains, sewers, water, gas, electrical, steam, and other utility service lines within working area.

2.5 Confidentiality. Contractor shall maintain the confidentiality of all information, documents, programs, procedures and all other items that Contractor encounters while performing the Work. This requirement shall be ongoing and shall survive the expiration or termination of this Contract and specifically includes, without limitation, all student, parent, and employee disciplinary information and health information.

2.6 Work during Instructional Time. By submitting its bid, Contractor affirms that Work may be performed during ongoing instruction in existing facilities. If so, Contractor agrees to cooperate to the best of its ability to minimize any disruption to school operations and any use of

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school facilities by the public up to, and including, rescheduling specific work activities, at no additional cost to District.

2.7 No Work during Student Testing. Contractor shall, at no additional cost to the District and at the District's request, coordinate its Work to not disturb District students including, without limitation, not performing any Work when students at the Site are taking State or Federally-required tests.

3. Badge Policy for Contractors

All Contractors doing work for the District will provide their workers with identification badges. These badges will be worn by all members of the Contractor's staff who are working in a District facility.

3.1 Badges must be filled out in full and contain the following information:

3.1.1 Name of Contractor

3.1.2 Name of Employee

3.1.3 Contractor's address and phone number

3.2 Badges are to be worn when the Contractor or his/her employees are on site and must be visible at all times. Contractors must inform their employees that they are required to allow District employees, the Architect, the Construction Manager, the Program Manager, or the Project Inspector to review the information on the badges upon request.

3.3 Continued failure to display identification badges as required by this policy may result in the individual being removed from the Project or assessment of fines against the Contractor.

4. Substitutions for Specified Items

Replace Section 1.7 in the General Conditions with the following provisions:

4.1 Whenever in the Specifications any materials, process, or article is indicated or specified by grade, patent, or proprietary name, or by name of manufacturer, that Specification shall be deemed to be followed by the words "or equal." Contractor may, unless otherwise stated, offer any material, process, or article that shall be substantially equal or better in every respect to that so indicated or specified.

4.1.1 If the material, process, or article offered by Contractor is not, in the opinion of the District, substantially equal or better in every respect to that specified, then Contractor shall furnish the material, process, or article specified in the Specifications without any additional compensation or change order.

4.1.2 This provision shall not be applicable with respect to any material, product, thing or service for which District made findings and gave notice in accordance with Public Contract Code section 3400(c); therefore, Contractor shall not be entitled to request a substitution with respect to those materials, products or services.

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4.2 A request for a substitution shall be submitted as follows:

4.2.1 Contractor shall notify the District in writing of any request for a substitution at least ten (10) days prior to bid opening as indicated in the Instructions to Bidders.

4.2.2 Requests for Substitutions after award of the Contract shall be submitted within thirty-five (35) days of the date of the Notice of Award.

4.3 Within 35 days after the date of the Notice of Award, Contractor shall provide data substantiating a request for substitution of "an equal" item, including but not limited to the following:

4.3.1 All variations of the proposed substitute from the material specified including, but not limited to, principles of operation, materials, or construction finish, thickness or gauge of materials, dimensions, weight, and tolerances;

4.3.2 Available maintenance, repair or replacement services;

4.3.3 Increases or decreases in operating, maintenance, repair, replacement, and spare parts costs;

4.3.4 Whether or not acceptance of the substitute will require other changes in the Work (or in work performed by the District or others under Contract with the District); and

4.3.5 The time impact on any part of the Work resulting directly or indirectly from acceptance of the proposed substitute.

4.4 No substitutions shall be made until approved, in writing, by the District. The burden of proof as to equality of any material, process, or article shall rest with Contractor. The Contractor warrants that if substitutes are approved:

4.4.1 The proposed substitute is equal or superior in all respects to that specified, and that such proposed substitute is suitable and fit for the intended purpose and will perform adequately the function and achieve the results called for by the general design and the Contract Documents;

4.4.2 The Contractor provides the same warranties and guarantees for the substitute that would be provided for that specified;

4.4.3 The Contractor shall be fully responsible for the installation of the substitute and any changes in the Work required, either directly or indirectly, because of the acceptance of such substitute, with no increase in Contract Price or Contract Time. Incidental changes or extra component parts required to accommodate the substitute will be made by the Contractor without a change in the Contract Price or Contract Time;

4.4.4 The Contractor shall be responsible for any re-design costs occasioned by District's acceptance and/or approval of any substitute; and

4.4.5 The Contractor shall, in the event that a substitute is less costly than that specified, credit the District with one hundred percent (100%) of the net difference between the substitute and the originally specified material. In this event, the Contractor agrees to execute a deductive Change Order to reflect that credit.

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4.5 In the event Contractor furnishes a material, process, or article more expensive than that specified, the difference in the cost of that material, process, or article so furnished shall be borne by Contractor.

4.6 In no event shall the District be liable for any increase in Contract Price or Contract Time due to any claimed delay in the evaluation of any proposed substitute or in the acceptance or rejection of any proposed substitute.

4.7 Contractor shall be responsible for any costs the District incurs for professional services, DSA fees, or delay to the Project Schedule, if applicable, while DSA reviews changes for the convenience of Contractor and/or to accommodate Contractor's means and methods. District may deduct those costs from any amounts owing to the Contractor for the review of the request for substitution, even if the request for substitution is not approved. District, at its sole discretion, shall deduct from the payments due to and/or invoice Contractor for all the professional services and/or DSA fees or delay to the Project Schedule, if applicable, while DSA reviews changes for the convenience of Contractor and/or to accommodate Contractor's means and methods arising herein.

5. Weather Days

Replace Section 15.2.1.5 in the General Conditions with the following:

15.2.1.5 The number of days of Adverse Weather exceeds the following parameters:

January	11	July	0
February	10	August	0
March	10	September	1
April	6	October	4
May	3	November	7
June	1	December	10

6. Insurance Policy Limits

All of Contractor's insurance shall be with insurance companies with an A.M. Best rating of no less than **A- or A:VII**. The limits of insurance shall not be less than:

Commercial General Liability	Product Liability and Completed Operations, Fire Damage Liability – Split Limit	\$2,000,000 per occurrence; \$4,000,000 aggregate
Automobile Liability – Any Auto	Combined Single Limit	\$1,000,000
Workers' Compensation		Statutory limits pursuant to State law
Employers' Liability		\$1,000,000
Builder's Risk (Course of Construction)		Issued for the value and scope of Work indicated herein.

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Pollution Liability		\$1,000,000 per claim; \$2,000,000 aggregate
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7. **Permits, Certificates, Licenses, Fees, Approvals**

7.1 Payment for Permits, Certificates, Licenses, Fees, and Approvals. As required in the General Conditions, the Contractor shall secure and pay for all permits, licenses, approvals, and certificates necessary for the prosecution of the Work with the exception of the following:

7.2 General Permit For Storm Water Discharges Associated With Construction and Land Disturbance Activities

7.2.1 Contractor acknowledges that all California school districts are obligated to develop and implement the following requirements for the discharge of storm water to surface waters from its construction and land disturbance activities (storm water requirements):

7.2.1.1 Projects that disturb less than one acre of land and are not part of a larger common plan of development or sale, in accordance with Title 24, Chapter 5.106.1, shall prevent the pollution of stormwater runoff from the construction activities through one or more of the following measures:

7.2.1.1.1 Comply with lawfully enacted stormwater management and/or erosion control ordinance.

7.2.1.1.2 Prevent loss of soil through wind or water erosion by adhering to a Storm Water Pollution Prevention Plan ("SWPPP") implementing an effective combination of erosion and sediment control and good housekeeping best management practices ("BMPs").

7.2.1.1.2.1 Soil loss BMP's that should be considered for implementation as appropriate for each project include, but are not limited to, the following:

7.2.1.1.2.1.1 Scheduling construction activity during dry weather, when possible.

7.2.1.1.2.1.2 Preservation of natural features, vegetation, soil, and buffers around surface waters.

7.2.1.1.2.1.3 Drainage swales or lined ditches to control stormwater flow.

7.2.1.1.2.1.4 Mulching or hydroseeding to stabilize disturbed soils.

7.2.1.1.2.1.5 Erosion control to protect slopes.

7.2.1.1.2.1.6 Protection of storm drain inlets (gravel bags or catch basin inserts).

7.2.1.1.2.1.7 Perimeter sediment control (perimeter silt fence, fiber rolls).

7.2.1.1.2.1.8 Sediment trap or sediment basin to retain sediment on site.

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7.2.1.1.2.1.9 Stabilized construction exits.

7.2.1.1.2.1.10 Wind erosion control.

7.2.1.1.2.1.11 Other soil loss BMP's acceptable to the enforcing agency.

7.2.1.1.2.2 Good housekeeping BMP's to manage construction equipment, materials, non-stormwater discharges, and wastes that should be considered for implementation as appropriate for each project include, but are not limited to, the following:

7.2.1.1.2.2.1 Dewatering activities.

7.2.1.1.2.2.2 Material handling and waste management.

7.2.1.1.2.2.3 Building materials stockpile management.

7.2.1.1.2.2.4 Management of washout areas (concrete, paints, stucco, etc.).

7.2.1.1.2.2.5 Control of vehicle/equipment fueling to contractor's staging area.

7.2.1.1.2.2.6 Vehicle and equipment cleaning performed off site.

7.2.1.1.2.2.7 Spill prevention and control.

7.2.1.1.2.2.8 Other housekeeping BMP's acceptable to the enforcing agency.

7.2.1.2 Projects that disturb one acre or more of land, or disturb less than one acre of land but are part of a larger common plan of development or sale shall comply with all lawfully enacted stormwater discharge regulations in accordance with Title 24, Chapter 5.106.2.

7.2.2 Contractor shall comply with any District storm water requirements that are approved by the District and applicable to the Project, at no additional cost to the District.

7.2.3 At no additional cost to the District, Contractor shall provide a Qualified Storm Water Practitioner who shall be onsite and implement and monitor any and all SWPPP requirements applicable to the Project, including but not limited to:

7.2.3.1 At least forty eight (48) hours prior to a forecasted rain event, implementing the Rain Event Action Plan (REAP) for any rain event requiring implementation of the REAP, including any erosion and sediment control measures needed to protect all exposed portions of the site; and

7.2.3.2 Monitoring any Numeric Action Levels (NALs), if applicable.

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8. Project Labor Agreement/Payroll Records

The District has entered into a Project Labor Agreement ("PLA"), which covers this Project. Accordingly, the following provision is added as Section 26.4.6:

26.4.6 As Contractor and its subcontractors have agreed to be bound by the terms of the PLA entered into by the District [on or about / dated] _____, Contractor and its subcontractors may be excused from uploading CPRs electronically using DIR's eCPR System by uploading the CPRs by electronic XML file or entering each record manually using the DIR's iform (or current form) online at <http://www.dir.ca.gov/Public-Works/Certified-Payroll-Reporting.html> , or by using a more current application and URL. However, within ten (10) days of any request by the District or Labor Commissioner, Contractor and its subcontractors shall provide CPRs 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 journeyman, apprentice, worker, or other employee employed by the Contractor and/or each subcontractor in connection with the Work.

9. As-Builts and Record Drawings

9.1 When called for by Division 1, Contractor shall submit As-Built Drawings pursuant to the Contract Documents consisting of one set of computer-aided design and drafting ("CADD") files in .DWG format, plus one set of As Built Drawings in electronic PDF format.

9.2 Contractor shall submit Record Drawings pursuant to the Contract Documents consisting of one set of computer-aided design and drafting ("CADD") files in in .DWG format, plus one set of Record Drawings on electronic PDF format.

10. Construction Manager

The District will use a Construction Manager on the Project that is the subject of this Contract. Kitchell CEM is the Construction Manager for this Project.

11. Program Manager

AECOM is the Program Manager designated for the Project that is the subject of this Contract.

12. Federal Funds

As this Project is funded in whole or in part by federal funds, Contractor and all Subcontractors are subject to civil or criminal prosecution for any violation of the federal False Claims Act set forth under section 1001 of title 18 and section 231 of title 31 of the United States Code.

13. Project Management Information System (PMIS)

The Contractor will be responsible to use the Project Management Information System (PMIS) supplied by the District as required. The PMIS will be used for all project documentation including but not limited to:

- (A) Applications for Payments
- (B) Change Order/Potential Change Orders (PCOs) Requests
- (C) Requests for Information (RFIs)

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- (D) Submittals
- (E) Daily Logs
- (F) Meeting Minutes
- (G) Reports

14. **Preliminary Schedule of Values**

The preliminary schedule of values shall include, at a minimum, the following information and the following structure:

Replace provision in the General Conditions with the following provisions:

14.1.1.2.3. The preliminary schedule of values shall not provide for values any greater than the following percentages of the Contract value:

14.1.2.3.1 Mobilization and layout combined to equal not more than **[1]**%;

14.1.1.2.3.2 Submittals, samples and shop drawings combined to equal not more than **[3]**%;

14.1.1.2.3.3 Bonds and insurance combined to equal not more than **[2]**%.

The following provisions are added as Section 27:

27. **FEDERAL LABOR, WAGE & HOUR, APPRENTICE, AND RELATED PROVISIONS**

27.1 **Minimum Wages**

The Davis-Bacon Act and 29 CFR parts 1 through 7 shall apply if the Project is financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution.

27.1.1 All laborers and mechanics employed or working upon the Site of the Work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the Project), will be paid unconditionally and not less often than 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 (29 CFR part 3) , the full amount of wages and bona fide fringe benefits, or cash equivalents thereof, due at time of payment computed at rates not less than those contained in the applicable wage determination of the Secretary of Labor regardless of any contractual relationship which 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 considered wages paid to such laborers or mechanics, subject to the provisions of this section, including but not limited to paragraph 27.1.7; 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 rate and fringe benefits on the wage determination for the classification of Work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing Work in more

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than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer'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 conformed under this section, including but not limited to paragraph 27.1.6 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.

27.1.2 Any class of laborers or mechanics, including helpers, and which is to be employed under the Contract which is not listed in the wage determination shall be classified in conformance with the wage determination. An additional classification and wage rate and fringe benefits will not be approved unless when the following criteria have been met:

27.1.2.1 The Work to be performed by the classification requested is not performed by a classification in the wage determination; and

27.1.2.2 The classification is utilized in the area by the construction industry; and

27.1.2.3 The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

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

27.1.4 In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives, and the District do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Contractor shall provide the questions, including the views of all interested parties and the recommendation of the District, to the District for the District's review and referral to the Administrator for determination.

27.1.5 The wage rate (including fringe benefits where appropriate) determined pursuant to 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.

27.1.6 Whenever the minimum wage rate prescribed in any applicable wage determination for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, 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.

27.1.7 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 the Contractor, that the applicable standards of the Davis-Bacon Act have been met. If the Secretary of Labor so requires, the Contractor shall set aside in a separate account sufficient assets to meet obligations under the plan or program.

27.2 Withholding. District may, 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

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under this Contract or any other Federal contract with the same Contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same 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 Contractor's or any Subcontractors' failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the Site of the Work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the Contract, the District may, after written notice to the Contractor, sponsor, applicant, or owner, take such action as it deems necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

27.3 Payrolls and basic records.

27.3.1 Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the Work and preserved for a period of three years thereafter for all laborers and mechanics working at the Site of the Work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each worker, his or her correct classification, hourly rates of wages 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 CFR 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 described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records that show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which 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.

27.3.2 The Contractor shall submit weekly for each week in which any Contract Work is performed a copy of all payrolls to the District. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information shall be submitted on a form acceptable to the District. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <https://www.dol.gov/whd/programs/dbra/wh347.htm> or its successor site. Contractor is responsible for the submission of copies of payrolls by all Subcontractors. Contractor and Subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the District, the Contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. Contractor may require a Subcontractor to provide addresses and social security numbers to the Contractor for its own records, without weekly submission to the District or other government agency.

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27.3.3 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 supervises the payment of the persons employed under the Contract and shall certify the following:

27.3.3.1 That the payroll for the payroll period contains the information required to be provided under 29 CFR 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5,

27.3.3.2 That the appropriate information is being maintained under 29 CFR 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and

27.3.3.3 That such information is correct and complete;

27.3.3.4 That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the Contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and

27.3.3.5 That no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

27.3.3.6 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 or applicable to the Contract.

27.3.3.7 The weekly submission of a properly executed certification in the form set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 27.3.3 of this section.

27.3.3.8 The falsification of any of the above certifications may subject the Contractor or one or more Subcontractors to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

27.3.3.9 The Contractor or Subcontractor shall make the records required under this section available for inspection, copying, or transcription by authorized representatives of the District or the federal Department of Labor, and shall permit representatives 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, the Federal agency 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. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

27.4 Apprentices and trainees

27.4.1 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, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first ninety (90) days of probationary employment as an apprentice in an eligible apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on

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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 journeyman hourly rate 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 full amount 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 Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, 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.

27.4.2 Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to Work at less than the predetermined rate for the Work performed unless they are employed pursuant to and individually registered in a program which 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 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 of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding 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 no longer be permitted to utilize trainees at less than the applicable predetermined rate for the Work performed until an acceptable program is approved.

27.4.3 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, as amended, and 29 CFR part 30.

27.5 Compliance with Copeland Act requirements. Contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this Contract.

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27.6 Subcontracts. The Contractor or Subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the Federal agency may by appropriate instructions require, and also a clause requiring the Subcontractors to include these clauses in any lower tier subcontracts. The Contractor shall be responsible for the compliance by any Subcontractor or lower tier Subcontractor with all the Contract clauses in 29 CFR 5.5.

27.7 Contract termination: debarment. A breach of the Contract clauses in 29 CFR 5.5 may be grounds for termination of the Contract, and for debarment as a Contractor and a Subcontractor as provided in 29 CFR 5.12.

27.8 Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this Contract.

27.9 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 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its Subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

27.10 Certification of eligibility.

27.10.1 By entering into this Contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who 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 CFR 5.12(a)(1).

27.10.2 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 CFR 5.12(a)(1).

27.10.3 Contractor shall be subject to the penalty for making false statements prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

27.11 Clauses Mandated by Contract Work Hours and Safety Standards Act.

As used in the following paragraphs, the terms laborers and mechanics include watchmen and guards.

27.11.1 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 he or she is employed on such Work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

27.11.2 Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in the foregoing paragraph the Contractor and any Subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and Subcontractor shall be liable to the United States 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 foregoing paragraph, in the sum of \$10 for

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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 the overtime wages required by the foregoing paragraph.

27.11.3 Withholding for unpaid wages and liquidated damages. The District may upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of Work performed by the Contractor or Subcontractor under the Contract or any other Federal contract with the same Contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same 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 forgoing paragraph.

27.11.4 Subcontracts. The Contractor or Subcontractor shall insert in any subcontracts the foregoing paragraphs concerning "Overtime requirements" and "Violation; liability for unpaid wages; liquidated damages" and also a clause requiring each Subcontractor to include these clauses in any lower tier subcontracts. Contractor shall be responsible for compliance by any Subcontractor or lower tier Subcontractor with the clauses set forth in paragraphs 27.11.1 through 27.11.4 of this section.

END OF SECTION

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SECTION 00 73 56 - HAZARDOUS MATERIALS PROCEDURES AND REQUIREMENTS

1. RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- (1) Section 01050: General Contractor Health & Safety Hazardous Materials Disclosure;
- (2) Section 02010: Hazardous Material Summary of Work;
- (3) Section 02080: Asbestos-Related Work;
- (4) Section 02090: Lead-Related Construction;
- (5) Section 02095: Pcb Ballasts, Pcb Ballasts, Universal Wastes, Orms.

2. Summary

This document includes information applicable to hazardous materials and hazardous waste abatement.

3. Notice of Hazardous Waste or Materials

- a. Contractor shall give notice in writing to the District, the Construction Manager, and the Architect promptly, before any of the following materials are disturbed, and in no event later than twenty-four (24) hours after first observance, of any:
 - (1) Material that Contractor believes may be a material that is hazardous waste or hazardous material, as defined in section 25117 of the Health and Safety Code, that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law;
 - (2) Other material that may present a substantial danger to persons or property exposed thereto in connection with Work at the site.
- b. Contractor's written notice shall indicate whether the hazardous waste or material was shown or indicated in the Contract Documents to be within the scope of Work, and whether the materials were brought to the site by Contractor, its Subcontractors, suppliers, or anyone else for whom Contractor is responsible. As used in this section the term "hazardous materials" shall include, without limitation, asbestos, lead, Polychlorinated biphenyl (PCB), petroleum and related hydrocarbons, and radioactive material.
- c. In response to Contractor's written notice, the District shall investigate the identified conditions.
- d. If the District determines that conditions do not involve hazardous materials or that no change in terms of Contract is justified, the District shall so notify Contractor in writing, stating reasons. If the District and Contractor cannot agree on whether conditions justify

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an adjustment in Contract Price or Contract Time, or on the extent of any adjustment, Contractor shall proceed with the Work as directed by the District.

- e. If after receipt of notice from the District, Contractor does not agree to resume Work based on a reasonable belief it is unsafe, or does not agree to resume Work under special conditions, then District may order such portion of Work that is in connection with such hazardous condition or such affected area to be deleted from the Work, or performed by others, or District may invoke its rights to terminate the Contract in whole or in part. District will determine entitlement to or the amount or extent of an adjustment, if any, in Contract Price or Contract Time as a result of deleting such portion of Work, or performing the Work by others.
- f. If Contractor stops Work in connection with any hazardous condition and in any area affected thereby, Contractor shall immediately redeploy its workers, equipment, and materials, as necessary, to other portions of the Work to minimize delay and disruption.

4. Additional Warranties and Representations

- a. Contractor represents and warrants that it, its employees, and its subcontractors and their employees, shall at all times have the required levels of familiarity with the Site and the Work, training, and ability to comply fully with all applicable laws and contractual requirements for safe and expeditious performance of the Work, including whatever training is or may be required regarding the activities to be performed (including, but not limited to, all training required to address adequately the actual or potential dangers of Contract performance).
- b. Contractor represents and warrants that it, its employees, and its subcontractors and their employees, shall at all times have and maintain in good standing any and all certifications and licenses required by applicable federal, state, and other governmental and quasi-governmental requirements applicable to the Work.
- c. Contractor represents and warrants that it has studied carefully all requirements of the Specifications regarding procedures for demolition, hazardous waste abatement, or safety practices, specified in the Contract, and prior to submitting its bid, has either (a) verified to its satisfaction that the specified procedures are adequate and sufficient to achieve the results intended by the Contract Documents, or (b) by way of approved "or equal" request or request for clarification and written Addenda, secured changes to the specified procedures sufficient to achieve the results intended by the Contract Documents. Contractor accepts the risk that any specified procedure will result in a completed Project in full compliance with the Contract Documents.

5. Monitoring and Testing

- a. District reserves the right, in its sole discretion, to conduct air monitoring, earth monitoring, Work monitoring, and any other tests (in addition to testing required under the agreement or applicable law), to monitor Contract requirements of safe and statutorily compliant work methods and (where applicable) safe re-entry level air standards under state and federal law upon completion of the job, and compliance of the work with periodic and final inspection by public and quasi-public entities having jurisdiction.
- b. Contractor acknowledges that District has the right to perform, or cause to be performed, various activities and tests including, but not limited to, pre-abatement, during abatement, and post-abatement air monitoring, that District shall have no obligation to perform said

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activities and tests, and that a portion of said activities and tests may take place prior to the completion of the Work by Contractor. In the event District elects to perform these activities and tests, Contractor shall afford District ample access to the Site and all areas of the Work as may be necessary for the performance of these activities and tests. Contractor will include the potential impact of these activities or tests by District in the Contract Price and the Scheduled Completion Date.

- c. Notwithstanding District's rights granted by this paragraph, Contractor may retain its own industrial hygiene consultant at Contractor's own expense and may collect samples and may perform tests including, but not limited to, pre-abatement, during abatement, and post-abatement personal air monitoring, and District reserves the right to request documentation of all such activities and tests performed by Contractor relating to the Work and Contractor shall immediately provide that documentation upon request.

6. Compliance with Laws

- a. Contractor shall perform safe, expeditious, and orderly work in accordance with the best practices and the highest standards in the hazardous waste abatement, removal, and disposal industry, the applicable law, and the Contract Documents, including, but not limited to, all responsibilities relating to the preparation and return of waste shipment records, all requirements of the law, delivering of all requisite notices, and obtaining all necessary governmental and quasi-governmental approvals.
- b. Contractor represents that it is familiar with and shall comply with all laws applicable to the Work or completed Work including, but not limited to, all federal, state, and local laws, statutes, standards, rules, regulations, and ordinances applicable to the Work relating to:
 - (1) The protection of the public health, welfare and environment;
 - (2) Storage, handling, or use of asbestos, PCB, lead, petroleum based products, radioactive material, or other hazardous materials;
 - (3) The generation, processing, treatment, storage, transport, disposal, destruction, or other management of asbestos, PCB, lead, petroleum, radioactive material, or hazardous waste materials or other waste materials of any kind; and
 - (4) The protection of environmentally sensitive areas such as wetlands and coastal areas.

7. Disposal

- a. Contractor has the sole responsibility for determining current waste storage, handling, transportation, and disposal regulations for the job Site and for each waste disposal facility. Contractor must comply fully at its sole cost and expense with these regulations and any applicable law. District may, but is not obligated to, require submittals with this information for it to review consistent with the Contract Documents.
- b. Contractor shall develop and implement a system acceptable to District to track hazardous waste from the Site to disposal, including appropriate "Hazardous Waste Manifests" on the EPA form, so that District may track the volume of waste it put in each landfill and receive from each landfill a certificate of receipt.

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- c. Contractor shall provide District with the name and address of each waste disposal facility prior to any disposal, and District shall have the express right to reject any proposed disposal facility. Contractor shall not use any disposal facility to which District has objected. Contractor shall document actual disposal or destruction of waste at a designated facility by completing a disposal certificate or certificate of destruction forwarding the original to the District.

8. Permits

- a. Before performing any of the Work, and at such other times as may be required by applicable law, Contractor shall deliver all requisite notices and obtain the approval of all governmental and quasi-governmental authorities having jurisdiction over the Work. Contractor shall submit evidence satisfactory to District that it and any disposal facility:
- (1) have obtained all required permits, approvals, and the like in a timely manner both prior to commencement of the Work and thereafter as and when required by applicable law; and
 - (2) are in compliance with all such permits, approvals and the regulations.

For example, before commencing any work in connection with the Work involving asbestos-containing materials, or PCBs, or other hazardous materials subject to regulation, Contractor agrees to provide the required notice of intent to renovate or demolish to the appropriate state or federal agency having jurisdiction, by certified mail, return receipt requested, or by some other method of transmittal for which a return receipt is obtained, and to send a copy of that notice to District. Contractor shall not conduct any Work involving asbestos-containing materials or PCBs unless Contractor has first confirmed that the appropriate agency having jurisdiction is in receipt of the required notification. All permits, licenses, and bonds that are required by governmental or quasi-governmental authorities, and all fees, deposits, tap fees, offsite easements, and asbestos and PCB disposal facilities expenses necessary for the prosecution of the Work, shall be procured and paid for by Contractor. Contractor shall give all notices and comply with the all applicable laws bearing on the conduct of the Work as drawn and specified. If Contractor observes or reasonably should have observed that Plans and Specifications and other Contract Documents are at variance therewith, it shall be responsible for promptly notifying District in writing of such fact. If Contractor performs any Work contrary to applicable laws, it shall bear all costs arising therefrom.

- b. In the case of any permits or notices held in District's name or of necessity to be made in District's name, District shall cooperate with Contractor in securing the permit or giving the notice, but the Contractor shall prepare for District review and execution upon approval, all necessary applications, notices, and other materials.

9. Indemnification

To the fullest extent permitted by law, the indemnities and limitations of liability expressed throughout the Contract Documents apply with equal force and effect to any claims or liabilities imposed or existing by virtue of the removal, abatement, and disposal of hazardous waste. This includes, but is not limited to, liabilities connected to the selection and use of a waste disposal facility, a waste transporter, personal injury, property damage, loss of use of property, damage to

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the environment or natural resources, or “disposal” and “release” of materials associated with the Work (as defined in 42 U.S.C. § 9601 *et seq.*).

10. Termination

District shall have an absolute right to terminate for default immediately without notice and without an opportunity to cure should Contractor knowingly or recklessly commit a material breach of the terms of the Contract Documents, or any applicable law, on any matter involving the exposure of persons or property to hazardous waste. However, if the breach of contract exposing persons or property to hazardous waste is due solely to an ordinary, unintentional, and non-reckless failure to exercise reasonable care, then the procedures for termination for cause shall apply without modification.

END OF SECTION

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Issue for Bid		Hazardous Material Procedures and Requirements

(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
N&T 22003	Oakland, California

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Issue for Bid		Hazardous Material Procedures and Requirements

(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
N&T 22003	Oakland, California

SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Site Access Conditions and Requirements;
- B. Special Conditions.

1.2 SUMMARY OF WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of this Contract consists of, but not limited to, the following:

This project consists of abatement and demolition of existing buildings and site improvements, construction of new classrooms, greenhouses and support spaces to house the Merritt College Landscape Horticulture Program, with associated site improvements. All buildings are single story. Occupancy classifications include A-3, B and U. Construction type is V-B, fully sprinkled. Automatic sprinkler system per NFPA 13, automatic fire alarm system per NFPA 72. Seismic zone E.

The work to be performed under this contract includes the furnishing of all labor, materials, equipment, transportation, services, permits, temporary controls and construction facilities, and all general conditions, seismic requirements, general requirements and incidentals required to complete the work on the project in its entirety as described in the contract documents.

1.3 CONTRACTS

- A. Perform the Work under a single, fixed-price Contract.

1.4 WORK BY OTHERS

- A. Work on the Project that will be performed by others concurrent with the Work of this Contract:
 - (1) Security Cameras.
 - (2) Display Monitors.
 - (3) Computer Server Equipment.

1.5 SALVAGE AND REINSTALLATION

- A. Removal and reinstallation of casework tops and other items as noted in the Contract documents.
- B. Reference Specification Section 02 41 19 for Landscape items to be salvaged and reinstalled.

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Issue for Bid		Summary of Work

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1.6 CODES, REGULATIONS, AND STANDARDS

- A. The codes, regulations, and standards adopted by the state and federal agencies having jurisdiction shall govern minimum requirements for this Project. Where codes, regulations, and standards conflict with the Contract Documents, these conflicts shall be brought to the immediate attention of the District and the Architect.
- B. Codes, regulations, and standards shall be as published effective as of date of bid opening, unless otherwise specified or indicated.
- C. The intent of the drawings and specifications is that the work of the alteration, rehabilitation or reconstruction is to be in accordance with Title 24, CCR. Should any existing conditions such as deterioration or non-complying construction be discovered which is not covered by the contract documents wherein the finished work will not comply with Title 24, CCR, a construction change document (CCD), or a separate set of plans and specifications, detailing and specifying the required work shall be submitted to and approved by the Division of the State Architect (DSA) before proceeding with the work.

1.7 EXAMINATION OF EXISTING CONDITIONS

- A. Contractor shall be held to have examined the Project Site and acquainted itself with the conditions of the Site and of the streets or roads approaching the Site.
- B. Prior to commencement of Work, Contractor shall survey the Site and existing buildings and improvements to observe existing damage and defects such as cracks, sags, broken, missing or damaged glazing, other building elements and Site improvements, and other damage.
- C. Should Contractor observe cracks, sags, and other damage to and defects of the Site and adjacent buildings, paving, and other items not indicated in the Contract Documents, Contractor shall immediately report same to the District and the Architect.

1.8 CONTRACTOR'S USE OF PREMISES

- A. If unoccupied and only with District's prior written approval, Contractor may use the building(s) at the Project Site without limitation for its operations, storage, and office facilities for the performance of the Work. If the District chooses to beneficially occupy any building(s), Contractor must obtain the District's written approval for Contractor's use of spaces and types of operations to be performed within the building(s) while so occupied. Contractor's access to the building(s) shall be limited to the areas indicated.
- B. If the space at the Project Site is not sufficient for Contractor's operations, storage, office facilities and/or parking, Contractor shall arrange and pay for any additional facilities needed by Contractor.
- C. Contractor shall not interfere with use of or access to occupied portions of the building(s) or adjacent property.
- D. Contractor shall maintain corridors, stairs, halls, and other exit-ways of building clear and free of debris and obstructions at all times.

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Issue for Bid		Summary of Work

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- E. No one other than those directly involved in the demolition and construction, or specifically designated by the District or the Architect shall be permitted in the areas of work during demolition and construction activities.
- F. The Contractor shall install the construction fence and maintain that it will be locked when not in use. Keys to this fencing will be provided to the District.

1.9 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

- A. The Drawings show above-grade and below-grade structures, utility lines, and other installations that are known or believed to exist in the area of the Work. Contractor shall locate these existing installations before proceeding with excavation and other operations that could damage same; maintain them in service, where appropriate; and repair damage to them caused by the performance of the Work. Should damage occur to these existing installations, the costs of repair shall be at the Contractor's expense and made to the District's satisfaction.
- B. Contractor shall be alert to the possibility of the existence of additional structures and utilities. If Contractor encounters additional structures and utilities, Contractor will immediately report to the District for disposition of same as indicated in the General Conditions.

1.10 UTILITY SHUTDOWNS AND INTERRUPTIONS

- A. Contractor shall give the District a minimum of three (3) days written notice in advance of any need to shut off existing utility services or to effect equipment interruptions. The District will set exact time and duration for shutdown, and will assist Contractor with shutdown. Work required to re-establish utility services shall be performed by the Contractor.
- B. Contractor shall obtain District's written approval as indicated in the General Conditions in advance of deliveries of material or equipment or other activities that may conflict with District's use of the building(s) or adjacent facilities.

1.11 STRUCTURAL INTEGRITY

- A. Contractor shall be responsible for and supervise each operation and work that could affect structural integrity of various building elements, both permanent and temporary.
- B. Contractor shall include structural connections and fastenings as indicated or required for complete performance of the Work.

PART 2 – PRODUCTS Not Used.

PART 3 – EXECUTION Not Used.

END OF SECTION

December 3, 2021	3	01 11 00
Issue for Bid		Summary of Work

(MLH)/Project No. 2463	Peralta Community College District
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Issue for Bid		Summary of Work

(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
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SECTION 01 21 00 - ALLOWANCE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-specified work.

1.2 RELATED SECTIONS

A. Document 01 10 00 (Summary of Work)

B. Document 01 29 00 (Payments and Completion)

C. Document 01 33 00 (Submittals)

1.3 ALLOWANCES

A. NOT APPLICABLE.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

December 3, 2021	1	01 21 00
Issue for Bid		Allowance

(MLH)/Project No. 2463	Peralta Community College District
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Issue for Bid		Allowance

(MLH)/Project No. 2463	Peralta Community College District
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DOCUMENT 01 22 00

ALTERNATES AND UNIT PRICING

PART 1 – ALTERNATES

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A.** General Conditions;
- B.** Special Conditions;
- C.** Bid Form and Proposal;
- D.** Instruction to Bidders.

1.02 DESCRIPTION

The items of work indicated below propose modifications to, substitutions for, additions to and/or deletions from the various parts of the Work specified in other Sections of the Specifications. The acceptance or rejection of any of the alternates is strictly at the option of the District subject to District's acceptance of Contractor's stated prices contained in this Proposal.

1.03 GENERAL

Where an item is omitted, or scope of Work is decreased, all Work pertaining to the item whether specifically stated or not, shall be omitted and where an item is added or modified or where scope of Work is increased, all Work pertaining to that required to render same ready for use on the Project in accordance with intention of Drawings and Specifications shall be included in an agreed upon price amount.

1.04 BASE BID

The Base Bid includes all work required to construct the Project completely and in accordance with the Contract Documents.

1.05 ALTERNATES

- A.** Alternate descriptions are general in nature and for reference purposes only. The Contract Documents, including, without limitation, the Drawings and Specifications, must be referred to for the complete scope of Work.
- B. Additive Alternate 1: NOT USED**
- C. Additive Alternate 2: ADDITIONAL GREENHOUSE EQUIPMENT**

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Issue for Bid		Alternates and Unit Pricing

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- (1) Base Bid: Refer to Specification Section 13 34 13 – Greenhouses: Equipment fit out for all Greenhouses to be as described in Parts 1-3.
- (2) Add Alternate: Refer to Specification Section 13 34 13 – Greenhouses: In addition to equipment specified in Parts 1-3, provide additional equipment as described in Part 4.

D. Additive Alternate 3: PAVING TYPE

- (1) Base Bid: Refer to Sheet L2.03: Paving Type P-08 to be Core Gravel paving as specified in Section 32 14 43 – Porous Unit Paving.
- (2) Add Alternate: Refer Sheets L2.00 and L2.03: Paving Type P-08 to be GrassCrete paving as specified in Section 32 14 43 – Porous Unit Paving.

E. Additive Alternate 4: GARDEN WATER FOUNTAINS

- (1) Base Bid: To each exterior fountain location shown on Sheet L2.02 provide outdoor weatherproof receptacle and irrigation water supply piping with pipe diameter stub out as shown on Irrigation Drawings, and shutoff valve.
- (2) Add Alternate: Refer to Specification Section 13 12 13 Exterior Fountains, and Sheets L2.02 and L5.03. Provide Garden Fountains Type A, B, and C. Connect to power and water provided under the Base Bid.

PART 2 - UNIT PRICING

2.01 GENERAL

Contractor shall completely state all required figures based on Unit Prices listed below. Where scope of Work is decreased, all Work pertaining to the item, whether specifically stated or not, shall be omitted and where scope of Work is increased, all work pertaining to that item required to render same ready for use on the Project in accordance with intention of Drawings and Specifications shall be included in an agreed upon price amount.

2.02 UNIT PRICES

Furnish unit prices for each of the named items on a square foot, lineal foot, or per each basis, as applies. Unit prices shall include all labor, materials, services, profit, overhead, insurance, bonds, taxes, and all other incidental costs of Contractor, subcontractors, and supplier(s).

- A.** Provide unit price per linear foot of drilled pier. Refer to Structural drawings for location and type of pier.

END OF DOCUMENT

December 3, 2021	2	01 22 00
Issue for Bid		Alternates and Unit Pricing

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SECTION 01 25 13 - PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. Instructions to Bidders;
- B. General Conditions, including, without limitation, Substitutions For Specified Items; and
- C. Special Conditions.

1.02 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT

- A. Catalog numbers and specific brands or trade names followed by the designation "or equal" are used in conjunction with material and equipment required by the Specifications to establish the standards of quality, utility, and appearance required. Substitutions which are equal in quality, utility, and appearance to those specified may be reviewed subject to the provisions of the General Conditions.
- B. Wherever more than one manufacturer's product is specified, the first-named product is the basis for the design used in the work and the use of alternative-named manufacturers' products or substitutes may require modifications in that design. If such alternatives are proposed by Contractor and are approved by the District and/or the Architect, Contractor shall assume all costs required to make necessary revisions and modifications of the design resulting from the substitutions requested by the Contractor.
- C. When materials and equipment are specified by first manufacturer's name and product number, second manufacturer's name and "or approved equal," supporting data for the second product, if proposed by Contractor, shall be submitted in accordance with the requirements for substitutions. The District's Board has found and determined that certain item(s) shall be used on this Project based on the purpose(s) indicated pursuant to Public Contract Code section 3400(c). These findings, as well as the products and brand or trade names, have been identified in the Notice to Bidders.
- D. The Contractor will not be allowed to substitute specified items unless the request for substitution is submitted as follows:
 - (1) District must receive any notice of request for substitution of a specified item a minimum of ten (10) calendar days prior to bid opening.
 - (2) Within 35 days after the date of the Notice of Award, the Contractor shall submit data substantiating the request(s) for all substitution(s) containing sufficient information to assess acceptability of product or system and impact on Project, including, without limitation, the requirements specified in the Special Conditions and the technical Specifications. Insufficient information shall be grounds for rejection of substitution.
- E. If the District and/or Architect, in reviewing proposed substitute materials and equipment, require revisions or corrections to be made to previously accepted Shop Drawings and

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Issue for Bid		Product Options and Substitutions

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supplemental supporting data to be resubmitted, Contractor shall promptly do so. If any proposed substitution is judged by the District and/or Architect to be unacceptable, the specified material or equipment shall be provided.

- F. Samples may be required. Tests required by the District and/or Architect for the determination of quality and utility shall be made at the expense of Contractor, with acceptance of the test procedure first given by the District.
- G. In reviewing the supporting data submitted for substitutions, the District and/or Architect will use for purposes of comparison all the characteristics of the specified material or equipment as they appear in the manufacturer's published data even though all the characteristics may not have been particularly mentioned in the Contract Documents. If more than two (2) submissions of supporting data are required, the cost of reviewing the additional supporting data shall be borne by Contractor, and the District will deduct the costs from the Contract Price. The Contractor shall be responsible for any re-design costs occasioned by District's acceptance and/or approval of any substitute.
- H. The Contractor shall, in the event that a substitute is less costly than that specified, credit the District with one hundred percent (100%) of the net difference between the substitute and the originally specified material. In this event, the Contractor agrees to execute a deductive Change Order to reflect that credit. In the event Contractor furnishes a material, process, or article more expensive than that specified, the difference in the cost of that material, process, or article so furnished shall be borne by Contractor.
- I. In no event shall the District be liable for any increase in Contract Price or Contract Time due to any claimed delay in the evaluation of any proposed substitute or in the acceptance or rejection of any proposed substitute.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END OF SECTION

December 3, 2021	2	01 25 12
Issue for Bid		Product Options and Substitutions

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SECTION 01 26 00 – CHANGES IN THE WORK

CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE PROVISIONS IN THE AGREEMENT, GENERAL CONDITIONS, AND SPECIAL CONDITIONS, IF USED, RELATED TO CHANGES AND/OR REQUESTS FOR CHANGES.

ALL SUBSTITUTIONS AFFECTING THE DIVISION OF THE STATE ARCHITECT (DSA) REGULATED ITEMS SHALL BE CONSIDERED AS A CONSTRUCTION CHANGE DOCUMENT OR ADDENDA, AND SHALL BE APPROVED BY DSA PRIOR TO FABRICATION AND INSTALLATION. (CAC, SECTION 4-338(c), IR A-6)

CONSTRUCTION CHANGE DOCUMENTS (CAC, SECTION 4-338 (c)) MUST BE SIGNED BY THE A/E OF RECORD, STRUCTURAL ENGINEER, AND DSA.

END OF SECTION

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Issue for Bid		Changes in the Work

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Issue for Bid		Changes in the Work

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**SECTION 01 29 00 - APPLICATION FOR PAYMENT AND
CONDITIONAL AND UNCONDITIONAL WAIVER AND RELEASE FORMS**

CONTRACTOR SHALL COMPLY WITH ALL PROVISIONS IN THE GENERAL CONDITIONS AND SPECIAL CONDITIONS RELATED TO APPLICATIONS FOR PAYMENT AND/OR PAYMENTS.

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Issue for Bid		Application for Payment and Conditional and Unconditional Waiver and Release Forms

(MLH)/Project No. 2463	Peralta Community College District
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N&T 22003	Oakland, California

**CONDITIONAL WAIVER AND RELEASE
ON PROGRESS PAYMENT
(CIVIL CODE SECTION 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.

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 progress 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 progress payment(s): \$_____

December 3, 2021	2	01 29 00
Issue for Bid		Application for Payment and Conditional and Unconditional Waiver and Release Forms

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- (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.

Claimant's Signature: _____

Claimant's Title: _____

Date of Signature: _____

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Issue for Bid		Application for Payment and Conditional and Unconditional Waiver and Release Forms

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**UNCONDITIONAL WAIVER AND RELEASE
ON PROGRESS PAYMENT
(CIVIL CODE SECTION 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.

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.

Claimant's Signature: _____

Claimant's Title: _____

Date of Signature: _____

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Issue for Bid		Application for Payment and Conditional and Unconditional Waiver and Release Forms

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**CONDITIONAL WAIVER AND RELEASE
ON FINAL PAYMENT
(CIVIL CODE SECTION 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.

Name of Claimant: _____

Name of Customer: _____

Job Location: _____

Owner: _____

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 check is 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: \$ _____

Claimant's Signature: _____

Claimant's Title: _____

Date of Signature: _____

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Issue for Bid		Application for Payment and Conditional and Unconditional Waiver and Release Forms

(MLH)/Project No. 2463	Peralta Community College District
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**UNCONDITIONAL WAIVER AND RELEASE
ON FINAL PAYMENT
(CIVIL CODE SECTION 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.

Name of Claimant: _____

Name of Customer: _____

Job Location: _____

Owner: _____

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 any of the following: _____

Disputed claims for extras in the amount of: \$ _____

Claimant's Signature: _____

Claimant's Title: _____

Date of Signature: _____

END OF SECTION

December 3, 2021	6	01 29 00
Issue for Bid		Application for Payment and Conditional and Unconditional Waiver and Release Forms

(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
N&T 22003	Oakland, California

SECTION 01 31 19 -PROJECT MEETINGS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions; and
- B. Special Conditions.

1.02 PROGRESS MEETINGS:

- A. Contractor shall schedule and hold regular weekly progress meetings after a minimum of one week's prior written notice of the meeting date and time to all Invitees as indicated below.
- B. Location: Contractor's field office. Meetings may be held virtually if mutually agreed upon with the Owner.
- C. The Contractor shall notify and invite the following entities ("Invitees"):
 - (1) District Representative.
 - (2) Contractor.
 - (3) Contractor's Project Manager.
 - (4) Contractor's Superintendent.
 - (5) Subcontractors, as appropriate to the agenda of the meeting.
 - (6) Suppliers, as appropriate to the agenda of the meeting.
 - (7) Construction Manager.
 - (8) Architect.
 - (9) Inspector of Record.
 - (10) Engineer(s), if any and as appropriate to the agenda of the meeting.
 - (11) Others, as appropriate to the agenda of the meeting.
- D. The District's, the Architect's, and/or an engineer's Consultants will attend at their discretion, in response to the agenda.
- E. The District representative, the Construction Manager, and/or another District Agent shall take and distribute meeting notes to attendees and other concerned parties. If exceptions are taken to anything in the meeting notes, those exceptions shall be stated in writing to the District within five (5) working days following District's distribution of the meeting notes.

December 3, 2021	1	01 31 19
Issue for Bid		Project Meetings

(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
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1.03 PRE-INSTALLATION/PERFORMANCE MEETING:

- A. Pre-Installation and Performance meeting requirements are described in the various technical sections of the Project Manual. At this meeting, invitees shall review and resolve conflicts, incompatibilities, or inadequacies discovered or anticipated.
- B. Contractor shall review in detail Project conditions, schedule, requirements for performance, application, installation, and quality of completed Work, and protection of adjacent Work and property.
- C. Contractor shall review in detail means of protecting the completed Work during the remainder of the construction period.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

December 3, 2021	2	01 31 19
Issue for Bid		Project Meetings

(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
N&T 22003	Oakland, California

SECTION 01 32 13 - SCHEDULING OF WORK

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions;
- C. Summary of Work; and
- D. Submittals.

1.02 SECTION INCLUDES

- A. Scheduling of Work under this Contract shall be performed by Contractor in accordance with requirements of this Section.
 - (1) Development of schedule, cost and resource loading of the schedule, monthly payment requests, and project status reporting requirements of the Contract shall employ computerized Critical Path Method ("CPM") scheduling ("CPM Schedule").
 - (2) CPM Schedule shall be cost loaded based on Schedule of Values as approved by District.
 - (3) Submit schedules and reports as specified in the General Conditions.
- B. Upon Award of Contract, Contractor shall immediately commence development of Initial and Original CPM Schedules to ensure compliance with CPM Schedule submittal requirements.

1.03 CONSTRUCTION SCHEDULE

- A. Within ten (10) days of issuance of the Notice to Proceed, and before request for first progress payment, the Contractor shall prepare and submit to the Project Manager a construction progress schedule conforming to the Milestone Schedule below.
- B. The Construction Schedule shall be continuously updated, and an updated schedule shall be submitted with each application for progress payment. Each revised schedule shall indicate the work actually accomplished during the previous period and the schedule for completion of the remaining work.
- C. Milestone Schedule:

ACTIVITY DESCRIPTION

DURATION

**ALL SUBMITTALS PROVIDED
SLAB-ON-GRADE COMPLETE
BUILDING WEATHER TIGHT**

**WITHIN 90 CALENDAR DAYS OF NTP
WITHIN 120 CALENDAR DAYS OF NTP
WITHIN 270 CALENDAR DAYS OF NTP**

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**SUBSTANTIAL PROJECT COMPLETION
FINAL PROJECT COMPLETION**

**WITHIN 390 CALENDAR DAYS OF NTP
WITHIN 420 CALENDAR DAYS OF NTP**

1.04 QUALIFICATIONS

- A. Contractor shall employ experienced scheduling personnel qualified to use the latest version of [i.e., Primavera Project Planner]. Experience level required is set forth below. Contractor may employ such personnel directly or may employ a consultant for this purpose.
- (1) The written statement shall identify the individual who will perform CPM scheduling.
 - (2) Capability and experience shall be verified by description of construction projects on which individual has successfully applied computerized CPM.
 - (3) Required level of experience shall include at least two (2) projects of similar nature and scope with value not less than three fourths ($\frac{3}{4}$) of the Total Bid Price of this Project. The written statement shall provide contact persons for referenced projects with current telephone and address information.
- B. District reserves the right to approve or reject Contractor's scheduler or consultant at any time. District reserves the right to refuse replacing of Contractor's scheduler or consultant, if District believes replacement will negatively affect the scheduling of Work under this Contract.

1.05 GENERAL

- A. Progress Schedule shall be based on and incorporate milestone and completion dates specified in Contract Documents.
- B. Overall time of completion and time of completion for each milestone shown on Progress Schedule shall adhere to times in the Contract, unless an earlier (advanced) time of completion is requested by Contractor and agreed to by District. Any such agreement shall be formalized by a Change Order.
- (1) District is not required to accept an early completion schedule, i.e., one that shows an earlier completion date than the Contract Time.
 - (2) Contractor shall not be entitled to extra compensation in event agreement is reached on an earlier completion schedule and Contractor completes its Work, for whatever reason, beyond completion date shown in its early completion schedule but within the Contract Time.
 - (3) A schedule showing the work completed in less than the Contract Time, and that has been accepted by District, shall be considered to have Project Float. The Project Float is the time between the scheduled completion of the work and the Completion Date. Project Float is a resource available to both District and the Contractor.
- C. Ownership Project Float: Neither the District nor Contractor owns Project Float. The Project owns the Project Float. As such, liability for delay of the Completion Date rests with the party whose actions, last in time, actually cause delay to the Completion Date.

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- (1) For example, if Party A uses some, but not all of the Project Float and Party B later uses remainder of the Project Float as well as additional time beyond the Project Float, Party B shall be liable for the time that represents a delay to the Completion Date.
 - (2) Party A would not be responsible for the time since it did not consume the entire Project Float and additional Project Float remained; therefore, the Completion Date was unaffected by Party A.
- D. Progress Schedule shall be the basis for evaluating job progress, payment requests, and time extension requests. Responsibility for developing Contract CPM Schedule and monitoring actual progress as compared to Progress Schedule rests with Contractor.
- E. Failure of Progress Schedule to include any element of the Work, or any inaccuracy in Progress Schedule, will not relieve Contractor from responsibility for accomplishing the Work in accordance with the Contract. District's acceptance of schedule shall be for its use in monitoring and evaluating job progress, payment requests, and time extension requests and shall not, in any manner, impose a duty of care upon District, or act to relieve Contractor of its responsibility for means and methods of construction.
- F. Software: Use the latest version of Primavera P6 and Microsoft Project. Such software shall be compatible with Windows operating system. Contractor shall transmit contract file to District on compact disk at times requested by District.
- G. Transmit each item under the form approved by District.
- (1) Identify Project with District Contract number and name of Contractor.
 - (2) Provide space for Contractor's approval stamp and District's review stamps.
 - (3) Submittals received from sources other than Contractor will be returned to the Contractor without District's review.

1.06 INITIAL CPM SCHEDULE

- A. Initial CPM Schedule submitted for review at the pre-construction conference shall serve as Contractor's schedule for up to ninety (90) calendar days after the Notice to Proceed.
- B. Indicate detailed plan for the Work to be completed in first ninety (90) days of the Contract; details of planned mobilization of plant and equipment; sequence of early operations; procurement of materials and equipment. Show Work beyond ninety (90) calendar days in summary form.
- C. Initial CPM Schedule shall be time scaled.
- D. Initial CPM Schedule shall be cost and resource loaded. Accepted cost and resource loaded schedule will be used as basis for monthly progress payments until acceptance of the Original CPM Schedule. Use of Initial CPM Schedule for progress payments shall not exceed ninety (90) calendar days.
- E. District and Contractor shall meet to review and discuss the Initial CPM Schedule within seven (7) calendar days after it has been submitted to District.

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- (1) District's review and comment on the schedule shall be limited to Contract conformance (with sequencing, coordination, and milestone requirements).
- (2) Contractor shall make corrections to schedule necessary to comply with Contract requirements and shall adjust schedule to incorporate any missing information requested by District. Contractor shall resubmit Initial CPM Schedule if requested by District.

F. If, during the first ninety (90) days after Notice to Proceed, the Contractor is of the opinion that any of the Work included on its Initial CPM Schedule has been impacted, the Contractor shall submit to District a written Time Impact Evaluation ("TIE") in accordance with Article 1.12 of this Section. The TIE shall be based on the most current update of the Initial CPM Schedule.

1.07 ORIGINAL CPM SCHEDULE

- A. Submit a detailed proposed Original CPM Schedule presenting an orderly and realistic plan for completion of the Work in conformance with requirements as specified herein.
- B. Progress Schedule shall include or comply with following requirements:
 - (1) Time scaled, cost and resource (labor and major equipment) loaded CPM schedule.
 - (2) No activity on schedule shall have duration longer than fifteen (15) work days, with exception of submittal, approval, fabrication and procurement activities, unless otherwise approved by District.
 - (a) Activity durations shall be total number of actual work days required to perform that activity.
 - (3) The start and completion dates of all items of Work, their major components, and milestone completion dates, if any.
 - (4) District furnished materials and equipment, if any, identified as separate activities.
 - (5) Activities for maintaining Project Record Documents.
 - (6) Dependencies (or relationships) between activities.
 - (7) Processing/approval of submittals and shop drawings for all material and equipment required per the Contract. Activities that are dependent on submittal acceptance or material delivery shall not be scheduled to start earlier than expected acceptance or delivery dates.
 - (a) Include time for submittals, re-submittals and reviews by District. Coordinate with accepted schedule for submission of Shop Drawings, samples, and other submittals.
 - (b) Contractor shall be responsible for all impacts resulting from re-submittal of Shop Drawings and submittals.

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- (8) Procurement of major equipment, through receipt and inspection at jobsite, identified as separate activity.
 - (a) Include time for fabrication and delivery of manufactured products for the Work.
 - (b) Show dependencies between procurement and construction.
- (9) Activity description; what Work is to be accomplished and where.
- (10) The total cost of performing each activity shall be total of labor, material, and equipment, excluding overhead and profit of Contractor. Overhead and profit of the General Contractor shall be shown as a separate activity in the schedule. Sum of cost for all activities shall equal total Contract value.
- (11) Resources required (labor and major equipment) to perform each activity.
- (12) Responsibility code for each activity corresponding to Contractor or Subcontractor responsible for performing the Work.
- (13) Identify the activities which constitute the controlling operations or critical path. No more than twenty-five (25%) of the activities shall be critical or near critical. Near critical is defined as float in the range of one (1) to (10) days.
- (14) Twenty (20) workdays for developing punch list(s), completion of punch-list items, and final clean-up for the Work or any designated portion thereof. No other activities shall be scheduled during this period.
- (15) Interface with the work of other contractors, District, and agencies such as, but not limited to, utility companies.
- (16) Show detailed Subcontractor Work activities. In addition, furnish copies of Subcontractor schedules upon which CPM was built.
 - (a) Also furnish for each Subcontractor, as determined by District, submitted on Subcontractor letterhead, a statement certifying that Subcontractor concurs with Contractor's Original CPM Schedule and that Subcontractor's related schedules have been incorporated, including activity duration, cost and resource loading.
 - (b) Subcontractor schedules shall be independently derived and not a copy of Contractor's schedule.
 - (c) In addition to Contractor's schedule and resource loading, obtain from electrical, mechanical, and plumbing Subcontractors, and other Subcontractors as required by District, productivity calculations common to their trades, such as units per person day, feet of pipe per day per person, feet of wiring per day per person, and similar information.
 - (d) Furnish schedule for Contractor/Subcontractor CPM schedule meetings which shall be held prior to submission of Original CPM schedule to District. District shall be permitted to attend scheduled meetings as an observer.

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- (17) Activity durations shall be in Work days.
- (18) Submit with the schedule a list of anticipated non-Work days, such as weekends and holidays. The Progress Schedule shall exclude in its Work day calendar all non-Work days on which Contractor anticipates critical Work will not be performed.
- C. Original CPM Schedule Review Meeting: Contractor shall, within sixty (60) days from the Notice to Proceed date, meet with District to review the Original CPM Schedule submittal.
 - (1) Contractor shall have its Project Manager, Project Superintendent, Project Scheduler, and key Subcontractor representatives, as required by District, in attendance. The meeting will take place over a continuous one (1) day period.
 - (2) District's review will be limited to submittal's conformance to Contract requirements including, but not limited to, coordination requirements. However, review may also include:
 - (a) Clarifications of Contract Requirements.
 - (b) Directions to include activities and information missing from submittal.
 - (c) Requests to Contractor to clarify its schedule.
 - (3) Within five (5) days of the Schedule Review Meeting, Contractor shall respond in writing to all questions and comments expressed by District at the Meeting.

1.08 ADJUSTMENTS TO CPM SCHEDULE

- A. Adjustments to Original CPM Schedule: Contractor shall have adjusted the Original CPM Schedule submittal to address all review comments from original CPM Schedule review meeting and resubmit network diagrams and reports for District's review.
 - (1) District, within ten (10) days from date that Contractor submitted the revised schedule, will either:
 - (a) Accept schedule and cost and resource loaded activities as submitted, or
 - (b) Advise Contractor in writing to review any part or parts of schedule which either do not meet Contract requirements or are unsatisfactory for District to monitor Project's progress, resources, and status or evaluate monthly payment request by Contractor.
 - (2) District may accept schedule with conditions that the first monthly CPM Schedule update be revised to correct deficiencies identified.
 - (3) When schedule is accepted, it shall be considered the "Original CPM Schedule" which will then be immediately updated to reflect the current status of the work.
 - (4) District reserves right to require Contractor to adjust, add to, or clarify any portion of schedule which may later be discovered to be insufficient for monitoring of Work or approval of partial payment requests. No additional compensation will be provided for such adjustments, additions, or clarifications.

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- B. Acceptance of Contractor's schedule by District will be based solely upon schedule's compliance with Contract requirements.
- (1) By way of Contractor assigning activity durations and proposing sequence of Work, Contractor agrees to utilize sufficient and necessary management and other resources to perform work in accordance with the schedule.
 - (2) Upon submittal of schedule update, updated schedule shall be considered "current" CPM Schedule.
 - (3) Submission of Contractor's schedule to District shall not relieve Contractor of total responsibility for scheduling, sequencing, and pursuing Work to comply with requirements of Contract Documents, including adverse effects such as delays resulting from ill-timed Work.
- C. Submittal of Original CPM Schedule, and subsequent schedule updates, shall be understood to be Contractor's representation that the Schedule meets requirements of Contract Documents and that Work shall be executed in sequence indicated on the schedule.
- D. Contractor shall distribute Original CPM Schedule to Subcontractors for review and written acceptance, which shall be noted on Subcontractors' letterheads to Contractor and transmitted to District for the record.

1.09 MONTHLY CPM SCHEDULE UPDATE SUBMITTALS

- A. Following acceptance of Contractor's Original CPM Schedule, Contractor shall monitor progress of Work and adjust schedule each month to reflect actual progress and any anticipated changes to planned activities.
- (1) Each schedule update submitted shall be complete, including all information requested for the Original CPM Schedule submittal.
 - (2) Each update shall continue to show all Work activities including those already completed. These completed activities shall accurately reflect "as built" information by indicating when activities were actually started and completed.
- B. A meeting will be held on approximately the twenty-fifth (25th) of each month to review the schedule update submittal and progress payment application.
- (1) At this meeting, at a minimum, the following items will be reviewed: Percent (%) complete of each activity; Time Impact Evaluations for Change Orders and Time Extension Request; actual and anticipated activity sequence changes; actual and anticipated duration changes; and actual and anticipated Contractor delays.
 - (2) These meetings are considered a critical component of overall monthly schedule update submittal and Contractor shall have appropriate personnel attend. At a minimum, these meetings shall be attended by Contractor's General Superintendent and Scheduler.
 - (3) Contractor shall plan on the meeting taking no less than four (4) hours.
- C. Within five (5) working days after monthly schedule update meeting, Contractor shall submit the updated CPM Schedule update.

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- D. Within five (5) work days of receipt of above noted revised submittals, District will either accept or reject monthly schedule update submittal.
- (1) If accepted, percent (%) complete shown in monthly update will be basis for Application for Payment by the Contractor. The schedule update shall be submitted as part of the Contractor's Application for Payment.
 - (2) If rejected, update shall be corrected and resubmitted by Contractor before the Application for Payment is submitted.
- E. Neither updating, changing or revising of any report, curve, schedule, or narrative submitted to District by Contractor under this Contract, nor District's review or acceptance of any such report, curve, schedule or narrative shall have the effect of amending or modifying in any way the Completion Date or milestone dates or of modifying or limiting in any way Contractor's obligations under this Contract.

1.10 SCHEDULE REVISIONS

- A. Updating the Schedule to reflect actual progress shall not be considered revisions to the Schedule. Since scheduling is a dynamic process, revisions to activity durations and sequences are expected on a monthly basis.
- B. To reflect revisions to the Schedule, the Contractor shall provide District with a written narrative with a full description and reasons for each Work activity revised. For revisions affecting the sequence of work, the Contractor shall provide a schedule diagram which compares the original sequence to the revised sequence of work. The Contractor shall provide the written narrative and schedule diagram for revisions two (2) working days in advance of the monthly schedule update meeting.
- C. Schedule revisions shall not be incorporated into any schedule update until the revisions have been reviewed by District. District may request further information and justification for schedule revisions and Contractor shall, within three (3) days, provide District with a complete written narrative response to District's request.
- D. If the Contractor's revision is still not accepted by District, and the Contractor disagrees with District's position, the Contractor has seven (7) calendar days from receipt of District's letter rejecting the revision to provide a written narrative providing full justification and explanation for the revision. The Contractor's failure to respond in writing within seven (7) calendar days of District's written rejection of a schedule revision shall be contractually interpreted as acceptance of District's position, and the Contractor waives its rights to subsequently dispute or file a claim regarding District's position.
- E. At District's discretion, the Contractor can be required to provide Subcontractor certifications of performance regarding proposed schedule revisions affecting said Subcontractors.

1.11 RECOVERY SCHEDULE

- A. If the Schedule Update shows a completion date twenty-one (21) calendar days beyond the Contract Completion Date, or individual milestone completion dates, the Contractor shall submit to District the proposed revisions to recover the lost time within seven (7) calendar days. As part of this submittal, the Contractor shall provide a written narrative for each revision made to recapture the lost time. If the revisions include sequence

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changes, the Contractor shall provide a schedule diagram comparing the original sequence to the revised sequence of work.

- B. The revisions shall not be incorporated into any schedule update until the revisions have been reviewed by District.
- C. If the Contractor's revisions are not accepted by District, District and the Contractor shall follow the procedures in paragraph 1.09.C, 1.09.D and 1.09.E above.
- D. At District's discretion, the Contractor can be required to provide Subcontractor certifications for revisions affecting said Subcontractors.

1.12 TIME IMPACT EVALUATION ("TIE") FOR CHANGE ORDERS, AND OTHER DELAYS

- A. When Contractor is directed to proceed with changed Work, the Contractor shall prepare and submit within fourteen (14) calendar days from the Notice to Proceed a TIE which includes both a written narrative and a schedule diagram depicting how the changed Work affects other schedule activities. The schedule diagram shall show how the Contractor proposes to incorporate the changed Work in the schedule and how it impacts the current schedule-update critical path. The Contractor is also responsible for requesting time extensions based on the TIE's impact on the critical path. The diagram must be tied to the main sequence of schedule activities to enable District to evaluate the impact of changed Work to the scheduled critical path.
- B. Contractor shall be required to comply with the requirements of Paragraph 1.09.A for all types of delays such as, but not limited to, Contractor/Subcontractor delays, adverse weather delays, strikes, procurement delays, fabrication delays, etc.
- C. Contractor shall be responsible for all costs associated with the preparation of TIEs, and the process of incorporating them into the current schedule update. The Contractor shall provide District with four (4) copies of each TIE.
- D. Once agreement has been reached on a TIE, the Contract Time will be adjusted accordingly. If agreement is not reached on a TIE, the Contract Time may be extended in an amount District allows, and the Contractor may submit a claim for additional time claimed by contractor.

1.13 TIME EXTENSIONS

- A. The Contractor is responsible for requesting time extensions for time impacts that, in the opinion of the Contractor, impact the critical path of the current schedule update. Notice of time impacts shall be given in accord with the General Conditions.
- B. Where an event for which District is responsible impacts the projected Completion Date, the Contractor shall provide a written mitigation plan, including a schedule diagram, which explains how (e.g., increase crew size, overtime, etc.) the impact can be mitigated. The Contractor shall also include a detailed cost breakdown of the labor, equipment, and material the Contractor would expend to mitigate District-caused time impact. The Contractor shall submit its mitigation plan to District within fourteen (14) calendar days from the date of discovery of the impact. The Contractor is responsible for the cost to prepare the mitigation plan.
- C. Failure to request time, provide TIE, or provide the required mitigation plan will result in Contractor waiving its right to a time extension and cost to mitigate the delay.

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- D. No time will be granted under this Contract for cumulative effect of changes.
- E. District will not be obligated to consider any time extension request unless the Contractor complies with the requirements of Contract Documents.
- F. Failure of the Contractor to perform in accordance with the current schedule update shall not be excused by submittal of time extension requests.
- G. If the Contractor does not submit a TIE within the required fourteen (14) calendar days for any issue, it is mutually agreed that the Contractor does not require a time extension for said issue.

1.14 SCHEDULE REPORTS

- A. Submit four (4) copies of the following reports with the Initial CPM Schedule, the Original CPM Schedule, and each monthly update.
- B. Required Reports:
 - (1) Two activity listing reports: one sorted by activity number and one by total Project Float. These reports shall also include each activity's early/late and actual start and finish dates, original and remaining duration, Project Float, responsibility code, and the logic relationship of activities.
 - (2) Cost report sorted by activity number including each activity's associated cost, percentage of Work accomplished, earned value- to date, previous payments, and amount earned for current update period.
 - (3) Schedule plots presenting time-scaled network diagram showing activities and their relationships with the controlling operations or critical path clearly highlighted.
 - (4) Cash flow report calculated by early start, late start, and indicating actual progress. Provide an exhibit depicting this information in graphic form.
 - (5) Planned versus actual resource (i.e., labor) histogram calculated by early start and late start.
- C. Other Reports:

In addition to above reports, District may request, from month to month, any two of the following reports. Submit four (4) copies of all reports.

 - (1) Activities by early start.
 - (2) Activities by late start.
 - (3) Activities grouped by Subcontractors or selected trades.
 - (4) Activities with scheduled early start dates in a given time frame, such as fifteen (15) or thirty (30) day outlook.
- D. Furnish District with report files on compact disks containing all schedule files for each report generated.

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1.15 PROJECT STATUS REPORTING

- A. In addition to submittal requirements for CPM scheduling identified in this Section, Contractor shall provide a monthly project status report (i.e., written narrative report) to be submitted in conjunction with each CPM Schedule as specified herein. Status reporting shall be in form specified below.
- B. Contractor shall prepare monthly written narrative reports of status of Project for submission to District. Written status reports shall include:
 - (1) Status of major Project components (percent (%) complete, amount of time ahead or behind schedule) and an explanation of how Project will be brought back on schedule if delays have occurred.
 - (2) Progress made on critical activities indicated on CPM Schedule.
 - (3) Explanations for any lack of work on critical path activities planned to be performed during last month.
 - (4) Explanations for any schedule changes, including changes to logic or to activity durations.
 - (5) List of critical activities scheduled to be performed next month.
 - (6) Status of major material and equipment procurement.
 - (7) Any delays encountered during reporting period.
 - (8) Contractor shall provide printed report indicating actual versus planned resource loading for each trade and each activity. This report shall be provided on weekly and monthly basis.
 - (a) Actual resource shall be accumulated in field by Contractor, and shall be as noted on Contractor's daily reports. These reports will be basis for information provided in computer-generated monthly and weekly printed reports.
 - (b) Contractor shall explain all variances and mitigation measures.
 - (9) Contractor may include any other information pertinent to status of Project. Contractor shall include additional status information requested by District at no additional cost.
 - (10) Status reports, and the information contained therein, shall not be construed as claims, notice of claims, notice of delay, or requests for changes or compensation.

1.16 WEEKLY SCHEDULE REPORT

At the Weekly Progress Meeting, the Contractor shall provide and present a time-scaled three (3) week look-ahead schedule that is based and correlated by activity number to the current schedule (i.e., Initial, Original CPM, or Schedule Update).

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1.17 DAILY CONSTRUCTION REPORTS

On a daily basis, Contractor shall submit a daily activity report to District for each workday, including weekends and holidays when worked. Contractor shall develop the daily construction reports on a computer-generated database capable of sorting daily Work, manpower, and man-hours by Contractor, Subcontractor, area, sub-area, and Change Order Work. Upon request of District, furnish computer disk of this data base. Obtain District's written approval of daily construction report data base format prior to implementation. Include in report:

- A. Project name and Project number.
- B. Contractor's name and address.
- C. Weather, temperature, and any unusual site conditions.
- D. Brief description and location of the day's scheduled activities and any special problems and accidents, including Work of Subcontractors. Descriptions shall be referenced to CPM scheduled activities.
- E. Worker quantities for its own Work force and for Subcontractors of any tier.
- F. Equipment, other than hand tools, utilized by Contractor and Subcontractors.

1.18 PERIODIC VERIFIED REPORTS

Contractor shall complete and verify construction reports on a form prescribed by the Division of the State Architect and file reports on the first day of February, May, August, and November during the preceding quarter year; at the completion of the Contract; at the completion of the Work; at the suspension of Work for a period of more than one (1) month; whenever the services of Contractor or any of Contractor's Subcontractors are terminated for any reason; and at any time a special verified report is required by the Division of the State Architect. Refer to section 4-336 and section 4-343 of Part 1, Title 24 of the California Code of Regulations.

PART 2 – PRODUCTS Not Used.

PART 3 - EXECUTION Not Used.

END OF SECTION

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SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
 - 3. Final Completion construction photographs.
 - 4. Preconstruction videos.
 - 5. Periodic construction video.
 - 6. General construction administration photographs or images.
 - 7. 360 Degree construction photographs.
 - 8. Web-, app-, and/or Cloud-based services for file access and storage.

1.02 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 33 00 - Submittal Procedures: Submitting photographic documentation.
- C. Section 01 56 39 – Tree and Plant Protection.
- D. Section 02 41 13 - Selective Demolition: Photographic documentation before selective demolition operations commence.
- E. Section 02 41 16 - Building Demolition: Photographic documentation before building demolition operations commence.

1.03 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.
 - 1. Digital Camera: Minimum sensor resolution of 8 megapixels.

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2. Format: Minimum 3648 by 2736 pixels, 200 dpi minimum, in unaltered original files, with same aspect ratio as the sensor, uncropped, date- and time- stamped, in folder named by date of photograph, accompanied by key plan file.
 3. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name of Architect and Construction Manager.
 - c. Name of Contractor.
 - d. Date photograph was taken.
 - e. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - f. Unique sequential identifier keyed to accompanying key plan.
- C. 360 Degree Digital Images: Submit image files within three days of taking photographs by posting to Web-based image service provider's Web site.
1. Digital Camera: Equipment shall be fully compatible with construction.
 2. Minimum sensor resolution of 8 megapixels.
 3. Format: Minimum 3648 by 2736 pixels, 200 dpi minimum, in unaltered original files, with same aspect ratio as the sensor, uncropped, date- and time- stamped, in folder named by date of photograph, accompanied by key plan file.
 4. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name of Architect [and Construction Manager].
 - c. Name of Contractor.
 - d. Date photograph was taken.
 - e. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - f. Unique sequential identifier keyed to accompanying key plan.

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1.04 QUALITY ASSURANCE

- A. Web-Based Photographic Documentation Service Provider: A firm specializing in providing photographic drone equipment, Web-based software, and related services for construction projects, with record of providing satisfactory services similar to those required for Project.

PART 2 PRODUCTS

2.01 360-DEGREE PHOTOGRAPHIC EQUIPMENT

- A. Wireless Hand-Held Camera: Provide portable camera system capable of producing 360 degree images meeting requirements of this Section.
1. Maintain a minimum of [two] 360-degree cameras at the construction site for use at any time.
 2. Provide battery charger, spare battery pack, and accessories to enable wireless camera operation throughout Project site.
 3. Cameras shall be capable of recording 360-degree video in either 1080p or 4K while providing high-resolution images and a dedicated chipset to help with image processing.

PART 3 EXECUTION

3.01 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
1. Date and Time: Include date and time in file name for each image.
 2. Images shall be accessible in the field office at Project site, to Architect and Construction Manager via shared file system with secure access.
 3. Images with people are acceptable.
- C. Preconstruction Photographs: Before commencement of excavation commencement of demolition starting construction, take color, digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different

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vantage points, as directed by Architect Construction Manager.

1. Flag excavation areas construction limits before taking construction photographs.
 2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
 3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Periodic Construction Photographs: Take 20 photographs monthly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- E. Architect Construction Manager-Directed Construction Photographs: From time to time, Architect Construction Manager may request additional photography or images, may select actual vantage points to show the status of construction and progress since last photographs were taken.
1. Three days' notice will be given, where feasible.
 2. In emergency situations, take additional photographs within 24 hours of request.
 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs to be taken at fabrication locations away from Project site.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
- F. General Construction Administration Photographs: Provide photographs as supporting documentation for Requests for Information and in circumstances where field conditions may require clarification. Construction administration photographs may be Digital Photographs or 360 Degree Digital Images at the Contractor's discretion.
1. Identification:

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- a. Name of Project.
 - b. Date photograph was taken.
 - c. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - d. RFI number or similar identifier if applicable.
- G. Unique sequential identifier keyed to accompanying key plan.
- H. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as Project Record Documents. Architect Construction Manager will direct photographer for desired vantage points.
1. Do not include date stamp.

3.02 360-DEGREE PHOTOGRAPHY

- A. General requirements and applications for 360-Degree photography are as specified for general digital photography.
- B. Protocols and naming conventions may be modified based on the web-based platform proposed and approved for this project.
- C. 360-degree images, or photospheres, are generated when the camera takes a photo through each of its two (or more) lenses at the same time. The camera joins the photos together to one 360° photo.

3.03 WEB-BASED CONSTRUCTION DOCUMENTATION

- A. 360-Degree Imagery Platform: Functionality shall provide a suite of functions typical for building construction and construction management similar to HoloBuilder.
<https://www.holobuilder.com/> .
1. Platform shall support both 360-degree and 2D photographs for Construction Progress Management
 2. Web interface, cloud-based platform, capable of making all images immediately accessible to project participants regardless of geographic location.
 3. Platform shall be capable of automatically organizing and tagging images by Project, floor plan, and date/time.
 4. Upon upload, platform shall permit immediate 360° viewing at any time regardless of geographic location.

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5. Platform shall be compatible with BIM, to allow comparison between 360° photos, BIM models, historical photos, and project schedules.
 6. Platform shall provide tools for markup, annotation and tagging of photos.
 7. Platform shall provide end-to-end encryption and a minimum 7-tier user management hierarchy.
 8. Platform shall allow Enterprise Administrators to give data access only on a “need to know” basis.
 9. All relevant documents and digital assets shall be stored in an organized digital progress record.
 10. Platform shall support conversion of digital progress records into closeout documentation.
- B. Maintain cameras and Web-based access in good working order in accordance with Web-based construction photographic documentation service provider's written instructions until final completion. Provide for service of cameras and related networking devices and software.

END OF SECTION

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SECTION 01 33 00 - SUBMITTALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Contractor's Submittals and Schedules, Drawings and Specifications;
- B. Special Conditions.

1.02 SECTION INCLUDES:

- A. Definitions:
 - (1) Shop Drawings and Product Data are as indicated in the General Conditions and include, but are not limited to, fabrication, erection, layout and setting drawings, formwork and falsework drawings, manufacturers' standard drawings, descriptive literature, catalogues, brochures, performance and test data, wiring and control diagrams. In addition, there are other drawings and descriptive data pertaining to materials, equipment, piping, duct and conduit systems, and methods of construction as may be required to show that the materials, equipment or systems and all positions conform to the requirement of the Contract Documents, including, without limitation, the Drawings.
 - (2) "Manufactured" applies to standard units usually mass-produced; "fabricated" means specifically assembled or made out of selected materials to meet design requirements. Shop Drawings shall establish the actual detail of manufactured or fabricated items, indicated proper relation to adjoining work and amplify design details of mechanical and electrical equipment in proper relation to physical spaces in the structure.
 - (3) Manufacturer's Instructions: Where any item of Work is required by the Contract Documents to be furnished, installed, or performed, at a minimum, in accordance with a specified product manufacturer's instructions, the Contractor shall procure and distribute copies of these to the District, the Architect, and all other concerned parties and shall furnish, install, or perform the work, at a minimum, in accordance with those instructions.
- B. Samples, Shop Drawings, Product Data, and other items as specified, in accordance with the following requirements:
 - (1) Contractor shall submit all Shop Drawings, Product Data, and Samples to the District, the Architect, the Project Inspector, and the Construction Manager.
 - (2) Contractor shall comply with all time frames herein and in the General Conditions and, in any case, shall submit required information in sufficient time to permit proper consideration and action before ordering any materials or items represented by such Shop Drawings, Product Data, and/or Samples.

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- (3) Contractor shall allow sufficient time so that no delay occurs due to required lead time in ordering or delivery of any item to the Site. Contractor shall be responsible for any delay in progress of Work due to its failure to observe these requirements.
- (4) Time for completion of Work shall not be extended on account of Contractor's failure to promptly submit Shop Drawings, Product Data, and/or Samples.
- (5) Reference numbers on Shop Drawings shall have Architectural and/or Engineering Contract Drawings reference numbers for details, sections, and "cuts" shown on Shop Drawings. These reference numbers shall be in addition to any numbering system that Contractor chooses to use or has adopted as standard.
- (6) When the magnitude or complexity of submittal material prevents a complete review within the stated time frame, Contractor shall make this submittal in increments to avoid extended delays.
- (7) Contractor shall certify on submittals for review that submittals conform to Contract requirements. Also certify that Contractor-furnished equipment can be installed in allocated space. In event of any variance, Contractor shall specifically state in transmittal and on Shop Drawings, portions vary and require approval of a substitute. Submittals shall not be used as a means of requesting a substitution.
- (8) Unless specified otherwise, sampling, preparation of samples, and tests shall be in accordance with the latest standard of the American Society for Testing and Materials.
- (9) Upon demand by Architect or District, Contractor shall submit samples of materials and/or articles for tests or examinations and consideration before Contractor incorporates same in Work. Contractor shall be solely responsible for delays due to sample(s) not being submitted in time to allow for tests. Acceptance or rejection will be expressed in writing. Work shall be equal to approved samples in every respect. Samples that are of value after testing will remain the property of Contractor.

C. Submittal Schedule:

- (1) Contractor shall prepare its proposed submittal schedule that is coordinated with the its proposed construction schedule and submit both to the District within ten (10) days after the date of the Notice to Proceed. Contractor's proposed schedules shall become the Project Construction Schedule and the Project Submittal Schedule after each is approved by the District.
- (2) Contractor is responsible for all lost time should the initial submittal be rejected, marked "revise and resubmit", etc.
- (3) All Submittals shall be forwarded to the District by the date indicated on the approved Submittal Schedule, unless an earlier date is necessary to maintain the Construction Schedule, in which case those Submittals shall be forwarded to the District so as not to delay the Construction Schedule.

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- (4) Contractor may be assessed \$100 a day for each day it is late in submitting a shop drawing or sample. No extensions of time will be granted to Trade Contractor or any Subcontractor because of its failure to have shop drawings and samples submitted in accordance with the Schedule.

1.03 SHOP DRAWINGS:

- A. Contractor shall submit Shop Drawings electronically, except for samples.
- B. Before commencing installation of any Work, the Contractor shall submit and receive approval of all drawings, descriptive data, and material list(s) as required to accomplish Work.
- C. Review of Shop Drawings is regarded as a service to assist Contractor and in all cases original Contract Documents shall take precedence as outlined under General Conditions.
- D. No claim for extra time or payment shall be based on work shown on Shop Drawings unless the claim is (1) noted on Contractor's transmittal letter accompanying Shop Drawings and (2) Contractor has complied with all applicable provisions of the General Conditions, including, without limitation, provisions regarding changes and payment, and all required written approvals.
- E. District shall not review Shop Drawings for quantities of materials or number of items supplied.
- F. District's and/or Architect's review of Shop Drawing will be general. District and/or Architect review does not relieve Contractor of responsibility for dimensions, accuracy, proper fitting, construction of Work, furnishing of materials, or Work required by Contract Documents and not indicated on Shop Drawings. The District's and/or Architect's review of Shop Drawings is not to be construed as approving departures from Contract Documents.
- G. Review of Shop Drawings and Schedules does not relieve Contractor from responsibility for any aspect of those Drawings or Schedules that is a violation of local, County, State, or Federal laws, rules, ordinances, or rules and regulations of commissions, boards, or other authorities or utilities having jurisdiction.
- H. Before submitting Shop Drawings for review, Contractor shall check Shop Drawings of its subcontractors for accuracy, and confirm that all Work contiguous with and having bearing on other work shown on Shop Drawings is accurately drawn and in conformance with Contract Documents.
- I. Submitted drawings and details must bear stamp of approval of Contractor:
 - (1) Stamp and signature shall clearly certify that Contractor has checked Shop Drawings for compliance with Drawings.
 - (2) If Contractor submits a Shop Drawing without an executed stamp of approval, or whenever it is evident (despite stamp) that Drawings have not been checked, the District and/or Architect will not consider them and will return them to the Contractor for revision and resubmission. In that event, it will be deemed that Contractor has not complied with this provision and Contractor shall bear risk of all delays to same extent as if it had not submitted any Shop Drawings or details.

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- J. Submission of Shop Drawings (in either original submission or when resubmitted with correction) constitutes evidence that Contractor has checked all information thereon and that it accepts and is willing to perform Work as shown.
- K. Contractor shall pay for cost of any changes in construction due to improper checking and coordination. Contractor shall be responsible for all additional costs, including coordination. Contractor shall be responsible for costs incurred by itself, the District, the Architect, the Project Inspector, the Construction Manager, any other Subcontractor or contractor, etc., due to improperly checked and/or coordination of submittals.
- L. Shop Drawings must clearly delineate the following information:
 - (1) Project name and address.
 - (2) Specification number and description.
 - (3) Architect's name and project number.
 - (4) Shop Drawing title, number, date, and scale.
 - (5) Names of Contractor, Subcontractor(s) and fabricator.
 - (6) Working and erection dimensions.
 - (7) Arrangements and sectional views.
 - (8) Necessary details, including complete information for making connections with other Work.
 - (9) Kinds of materials and finishes.
 - (10) Descriptive names of materials and equipment, classified item numbers, and locations at which materials or equipment are to be installed in the Work. Contractor shall use same reference identification(s) as shown on Contract Drawings.
- M. Contractor shall prepare composite drawings and installation layouts when required to solve tight field conditions.
 - (1) Shop Drawings shall consist of dimensioned plans and elevations and must give complete information, particularly as to size and location of sleeves, inserts, attachments, openings, conduits, ducts, boxes, structural interferences, etc.
 - (2) Contractor shall coordinate these composite Shop Drawings and installation layouts in the field between itself and its Subcontractor(s) for proper relationship to the Work, the work of other trades, and the field conditions. The Contractor shall check and approve all submittal(s) before submitting them for final review.

1.04 PRODUCT DATA OR NON REPRODUCIBLE SUBMITTALS:

- A. Contractor shall submit manufacturer's printed literature electronically.
- B. Contractor shall submit a complete list of all major items of mechanical, plumbing, and electrical equipment and materials in accordance with the approved Submittal Schedule,

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except as required earlier to comply with the approved Construction Schedule. Other items specified are to be submitted prior to commencing Work. Contractor shall submit items of like kind at one time in a neat and orderly manner. Partial lists will not be acceptable.

- C. Submittals shall include manufacturer's specifications, physical dimensions, and ratings of all equipment. Contractor shall furnish performance curves for all pumps and fans. Where printed literature describes items in addition to that item being submitted, submitted item shall be clearly marked on sheet and superfluous information shall be crossed out. If highlighting is used, Contractor shall mark all copies.
- D. Equipment submittals shall be complete and include space requirements, weight, electrical and mechanical requirements, performance data, and supplemental information that may be requested.
- E. Imported Materials Certification must be submitted at least ten (10) days before material is delivered.

1.05 SAMPLES:

- A. Contractor shall submit for approval Samples as required and within the time frame in the Contract Documents. Materials such as concrete, mortar, etc., which require on-site testing will be obtained from Project Site.
- B. Contractor shall submit four (4) samples except where greater or lesser number is specifically required by Contract Documents including, without limitation, the Specifications.
 - (1) Samples must be of sufficient size and quality to clearly illustrate functional characteristics, with integrally related parts and attachment devices.
 - (2) Samples must show full range of texture, color, and pattern.
- C. Contractor shall make all Submittals, unless it has authorized Subcontractor(s) to submit and Contractor has notified the District in writing to this effect.
- D. Samples to be shipped prepaid or hand-delivered to the District.
- E. Contractor shall mark samples to show name of Project, name of Contractor submitting, Contract number and segment of Work where representative Sample will be used, all applicable Specifications Sections and documents, Contract Drawing Number and detail, and ASTM or FS reference, if applicable.
- F. Contractor shall not deliver any material to Site prior to receipt of District's and/or Architect's completed written review and approval. Contractor shall furnish materials equal in every respect to approved Samples and execute Work in conformance therewith.
- G. District's and/or Architect's review, acceptance, and/or approval of Sample(s) will not preclude rejections of any material upon discovery of defects in same prior to final acceptance of completed Work.
- H. After a material has been approved, no change in brand or make will be permitted.

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- I. Contractor shall prepare its Submittal Schedule and submit Samples of materials requiring laboratory tests to specified laboratory for testing not less than ninety (90) days before such materials are required to be used in Work.
- J. Samples which are rejected must be resubmitted promptly after notification of rejection and be marked "Resubmitted Sample" in addition to other information required.
- K. Field Samples and Mock-Ups are to be removed by Contractor at District's direction:
 - (1) Size: As Specified.
 - (2) Furnish catalog numbers and similar data, as requested.

1.06 REVIEW AND RESUBMISSION REQUIREMENTS:

- A. The District will arrange for review of Sample(s), Shop Drawing(s), Product Data, and other submittal(s) by appropriate reviewer and return to Contractor as provided below within twenty-one (21) days after receipt or within twenty-one (21) days after receipt of all related information necessary for such review, whichever is later.
- B. One (1) copy of product or materials data will be returned to Contractor with the review status.
- C. Samples to be incorporated into the Work will be returned to Contractor, together with a written notice designating the Sample with the appropriate review status and indicating errors discovered on review, if any. Other Samples will not be returned, but the same notice will be given with respect thereto, and that notice shall be considered a return of the Sample.
- D. Contractor shall revise and resubmit any Sample(s), Shop Drawing(s), Product Data, and other submittal(s) as required by the reviewer. Such resubmittals will be reviewed and returned in the same manner as original Sample(s), Shop Drawing(s), Product Data, and other submittal(s), within fourteen (14) days after receipt thereof or within fourteen (14) days after receipt of all related information necessary for such review. Such resubmittal shall not delay the Work.
- E. Contractor may proceed with any of the Work covered by Sample(s), Shop Drawing(s), Product Data, and other submittal(s) upon its return if designated as no exception taken, or revise as noted, provided the Contractor proceeds in accordance with the District and/or the Architect's notes and comments.
- F. Contractor shall not begin any of the work covered by a Sample(s), Shop Drawing(s), Product Data, and other submittal(s), designated as revise and resubmit or rejected, until a revision or correction thereof has been reviewed and returned to Contractor.
- G. Sample(s), Shop Drawing(s), Product Data, and other submittal(s) designated as revise and resubmit or rejected and requiring resubmittal, shall be revised or corrected and resubmitted to the District no later than fourteen (14) days or a shorter period as required to comply with the approved Construction Schedule, after its return to Contractor.
- H. Neither the review nor the lack of review of any Sample(s), Shop Drawing(s), Product Data, and other submittal(s) shall waive any of the requirements of the Contract Documents, or relieve Contractor of any obligation thereunder.

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- I. District's and/or Architect's review of Shop Drawings does not relieve the Contractor of responsibility for any errors that may exist. Contractor is responsible for the dimensions and design of adequate connections and details and for satisfactory construction of all the Work.

PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

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SECTION 01 35 13.23 - SITE STANDARDS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including without limitation, Site Access, Conditions, and Regulations;
- B. Special Conditions;
- C. Drug-Free Workplace Certification;
- D. Tobacco-Free Environment Certification;
- E. Criminal Background Investigation/Fingerprinting Certification;
- F. Temporary Facilities and Controls.

1.02 REQUIREMENTS OF THE DISTRICT:

- A. Drug-Free Schools and Safety Requirements:
 - (1) All school sites and other District Facilities have been declared "Drug-Free Zones." No drugs, alcohol and/or smoking are allowed at any time in any buildings and/or grounds on District property. No students, staff, visitors, or contractors are to use drugs on these sites.
 - (2) Smoking and the use of tobacco products by all persons is prohibited on or in District property. District property includes school buildings, school grounds, school-owned vehicles and vehicles owned by others while on District property. Contractor shall post: "Non-Smoking Area" in a highly visible location in each work area, staging area, and parking area. Contractor may designate a smoking area outside of District property within the public right-of-way, provided that this area remains quiet and unobtrusive to adjacent neighbors. This smoking area is to be kept clean at all times.
 - (3) Contractor shall ensure that no alcohol, firearms, weapons, or controlled substances enter or are used at the Site. Contractor shall immediately remove from the Site and terminate the employment of any employee(s) found in violation of this provision.
- B. Language: Profanity or other unacceptable and/or loud language will not be tolerated, "Cat calls" or other derogatory language toward students, staff, volunteers, parents or public will not be allowed.
- C. Disturbing the Peace (Noise and Lighting):
 - (1) Contractor shall observe the noise ordinance of the Site at all times including, without limitation, all applicable local, city, and/or state laws, ordinances, and/or regulations regarding noise and allowable noise levels.

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(2) The use of radios, etc., shall be controlled to keep all sound at a level that cannot be heard beyond the immediate area of use. District reserves the right to prohibit the use of radios at the Site, except for mobile phones or other handheld communication radios.

(3) If portable lights are used after dark, all light must be located so as not to direct light into neighboring property.

D. Traffic:

(1) Driving on the Premises shall be limited to periods when students and public are not present. If driving or deliveries must be made during the school hours, two (2) or more ground guides shall lead the vehicle across the area of travel. In no case shall driving take place across playgrounds or other pedestrian paths during recess, lunch, and/or class period changes. The speed limit on-the Premises shall be five (5) miles per hour (maximum) or less if conditions require.

(2) All paths of travel for deliveries, including without limitation, material, equipment, and supply deliveries, shall be reviewed and approved by District in advance. Any damage will be repaired to the pre-damaged condition by the Contractor.

(3) District shall designate a construction entry to the Site. If Contractor requests, District determines it is required, and to the extent possible, District shall designate a staging area so as not to interfere with the normal functioning of school facilities. Location of gates and fencing shall be approved in advance with District and at Contractor's expense.

(4) Parking areas shall be reviewed and approved by District in advance. No parking is to occur under the drip line of trees or in softscape areas that could otherwise be damaged.

E. All of the above shall be observed and complied with by the Contractor and all workers on the Site. Failure to follow these directives could result in individual(s) being suspended or removed from the work force at the discretion of the District. The same rules and regulations shall apply equally to delivery personnel, inspectors, consultants, and other visitors to the Site.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

PART 4 - SITE LOGISTICS PLANS

See Pages 4 and 5 of this specification.

END OF SECTION

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SECTION 01 41 00 - REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Obtaining of Permits, Licenses and Registrations and Work to Comply with All Applicable Laws and Regulations;
- B. Special Conditions; and
- C. Quality Control.

1.02 DESCRIPTION:

This section covers the general requirements for regulatory requirements pertaining to the Work and is supplementary to all other regulatory requirements mentioned or referenced elsewhere in the Contract Documents.

1.03 REQUIREMENTS OF REGULATORY AGENCIES:

- A. All statutes, ordinances, laws, rules, codes, regulations, standards, and the lawful orders of all public authorities having jurisdiction over the Work, are hereby incorporated into these Contract Documents as if repeated in full herein and are intended to be included in any reference to Code or Building Code, unless otherwise specified, including, without limitation, the references in the list below. Contractor shall make available at the Site copies of all the listed documents applicable to the Work as the District and/or Architect may request, including, without limitation, applicable portions of the California Code of Regulations ("CCR").

- (1) California Building Standards Administrative Code, Part 1, Title 24, CCR.
- (2) California Building Code (CBC), Part 2, Title 24, CCR; (International Building Code volumes 1-2 and California Amendments).
- (3) California Electrical Code (CEC), Part 3, Title 24, CCR; (National Electrical Code and California Amendments).
- (4) California Mechanical Code (CMC), Part 4, Title 24, CCR; (Uniform Mechanical Code and California Amendments).
- (5) California Plumbing Code (CPC), Part 5, Title 24, CCR; (Uniform Plumbing Code and California Amendments).
- (6) California Fire Code (CFC), Part 9, Title 24, CCR; (International Fire Code and California Amendments).
- (7) California Green Building Standards Code (CALGreen), Part 11, Title 24, CCR.
- (8) California Referenced Standards Code, Part 12, Title 24, CCR.

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- (9) State Fire Marshal Regulations, Public Safety, Title 19, CCR.
 - (10) Partial List of Applicable National Fire Protection Association (NFPA) Standards:
 - (a) NFPA 13 - Automatic Sprinkler System.
 - (b) NFPA 14 - Standpipes Systems.
 - (c) NFPA 17A - Wet Chemical System
 - (d) NFPA 24 - Private Fire Mains.
 - (e) (California Amended) NFPA 72 - National Fire Alarm Codes.
 - (f) NFPA 253 - Critical Radiant Flux of Floor Covering System.
 - (g) NFPA 2001 - Clean Agent Fire Extinguishing Systems.
 - (11) California Division of the State Architect interpretation of Regulations ("DSA IR"), including, without limitation:
 - (a) DSA IR A-6 — Construction Change Document Submittal and Approval Processes.
 - (b) DSA IR A-7 — Project Inspector Certification and Approval.
 - (c) DSA IR A-8 — Project Inspector and Assistant Inspector Duties and Performance.
 - (d) DSA IR A-12 — Assistant Inspector Approval.
 - (12) DSA Procedures ("DSA PR")
 - (a) DSA PR 13-01 – Construction Oversight Process
 - (13) DSA PR 13-02 – Project Certification Process
- B. This Project shall be governed by applicable regulations, including, without limitation, the State of California's Administrative Regulations for the Division of the State Architect-Structural Safety (DSA/SS), Chapter 4, Part 1, Title 24, CCR, and the most current version on the date the bids are opened and as it pertains to school construction including, without limitation:
- (1) Test and testing laboratory per Section 4-335. District shall pay for the testing laboratory.
 - (2) Special inspections per Section 4-333(c).
 - (3) Deferred Approvals per section 4-317(g).
 - (4) Verified reports per Sections 4-336 & 4-343(c).
 - (5) Duties of the Architect & Engineers shall be per Section 4-333(a) and 4-341.

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- (6) Duties of the Contractor shall be per Section 4-343.
- (7) Duties of Project Inspector shall be per Section 4-334.
- (8) Addenda and Construction Change Documents per Section 4-338.

Contractor shall keep and make available all applicable parts of the most current version of Title 24 referred to in the plans and specifications at the Site during construction.

C. If applicable, items of deferred approval shall be clearly marked on the Architect's and/or Engineer's approved Drawings. All items later submitted for approval shall be per Title 24 requirements to the DSA.

- (1) Contractor shall submit the following to Architect for review and endorsement:
 - (a) Product information on proposed material/system supplier.
 - (b) Drawings, specifications, and calculations prepared, signed, and stamped by an architect or engineer licensed in the State of California for that portion of the Work.
 - (c) All other requirements as may be required by DSA.
- (2) Cost of preparing and submitting documentation per DSA Deferred Approval requirements including required modifications to Drawings and Specifications, whether or not indicated in the Contract Documents, shall be borne by Contractor.
- (3) Contractor shall not begin fabrication and installation of deferred approval items without first obtaining DSA approval of Drawings and Specifications.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END OF SECTION

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SECTION 01 42 13 - ABBREVIATIONS AND ACRONYMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions including without limitation, Definitions;
- B. Special Conditions.

1.02 DOCUMENT INCLUDES:

- A. Abbreviations used throughout the Contract Documents.
- B. Reference to a technical society, organization, or body is by abbreviation, as follows:

- | | | |
|-----|--------|---|
| 1. | AA | Aluminum Association |
| 2. | AAMA | Architectural Aluminum Manufacturers Association |
| 3. | AASHTO | American Association of State Highway and Transportation Officials |
| 4. | ABPA | Acoustical and Board Products Association |
| 5. | ACI | American Concrete Institute |
| 6. | AGA | American Gas Association |
| 7. | AGC | Associated General Contractors |
| 8. | AHC | Architectural Hardware Consultant |
| 9. | AHRI | Air Conditioning, Heating, Refrigeration Institute |
| 10. | AI | Asphalt Institute |
| 11. | AIA | American Institute of Architects |
| 12. | AIEE | American Institute of Electrical Engineers |
| 13. | AISC | American Institute of Steel Construction |
| 14. | AISI | American Iron and Steel Institute |
| 15. | AMCA | Air Moving and Conditioning Association |
| 16. | ANSI | American National Standards Institute |
| 17. | APA | American Plywood Association |
| 18. | ARI | Air Conditioning and Refrigeration Institute |
| 19. | ASHRAE | American Society of Heating, Refrigeration and Air Conditioning Engineers |
| 20. | ASSE | American Society of Civil Engineers |
| 21. | ASME | American Society of Mechanical Engineers |
| 22. | ASTM | American Society of Testing and Materials |
| 23. | AWPA | American Wood Protection Association |
| 24. | AWPI | American Wood preservers Institute |
| 25. | AWS | American Welding Society |
| 26. | AWSC | American Welding Society Code |
| 27. | AWI | Architectural Woodwork Institute |
| 28. | AWWA | American Water Works Association |
| 29. | BIA | The Brick Industry Association |
| 30. | CCR | California Code of Regulations |
| 31. | CLFMI | Chain Link Fence Manufacturers Institute |
| 32. | CRA | California Redwood Association |
| 33. | CRSI | Concrete Reinforcing Steel Institute |

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Issue for Bid		Abbreviations and Acronyms

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34.	CS	Commercial Standards
35.	CSI	Construction Specifications Institute
36.	CTI	Cooling Tower Institute
37.	FGMA	Flat Glass Manufacturer's Association
38.	FIA	Factory Insurance Association
39.	FM	Factory Mutual Global
40.	FS/FED SPEC	Federal Specification
41.	FTI	Facing Title Institute
42.	GA	Gypsum Association
43.	IAPMO	International Association of Plumbing and Mechanical Officials
44.	ICC	International Code Council
45.	IEEE	Institute of Electrical and Electronic Engineers
46.	IES	Illumination Engineering Society
47.	LIA	Lead Industries Association
48.	MCAC	Mason Contractors Association of California
49.	MIMA	Mineral Wool Insulation Manufacturers Association
50.	MLMA	Metal Lath Manufacturers Association
51.	MS/MIL SPEC	Military Specifications
52.	NAAMM	National Association of Architectural Metal Manufacturers
53.	NBHA	National Builders Hardware Association
54.	NBFU	National Board of Fire Underwriters
55.	NBS	National Bureau of Standards
56.	NCMA	National Concrete Masonry Association
57.	NCSEA	National Council of Structural Engineers Associations
58.	NEC	National Electrical Code
59.	NEMA	National Electrical Manufacturers Association
60.	NSI	Natural Stone Institute
61.	NTMA	National Terrazzo and Mosaic Association
62.	NWMA	National Woodwork Manufacturer's Association
63.	ORS	Office of Regulatory Services (California)
64.	OSHA	Occupational Safety and Health Act
65.	PCI	Precast Concrete Institute
66.	PCA	Portland Cement Association
67.	PDCA	Painting and Decorating Contractors of America
68.	PDI	Plumbing Drainage Institute
69.	PEI	Porcelain Enamel Institute
70.	PG&E	Pacific Gas & Electric Company
71.	PS	Product Standards
72.	SDI	Steel Door Institute; Steel Deck Institute
73.	SJI	Steel Joist Institute
74.	SSPC	Steel Structures Painting Council
75.	TPI	Truss Plate Institute
76.	UL	Underwriters Laboratories Code
77.	UMC	Uniform Mechanical Code
78.	USDA	United States Department of Agriculture
79.	VI	Vermiculite Institute
80.	WCLIB	West Coast Lumberman's Inspection Bureau
81.	WEUSER	Western Electric Utilities Service Engineering Requirements
82.	WIC	Woodwork Institute of California

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PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

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SECTION 01 42 16 - DEFINITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions including without limitation, Definitions;
- B. Special Conditions.

1.02 QUALITY ASSURANCE

- A. For products or workmanship specified by association, trade, or Federal Standards, Contractor shall comply with requirements of the standard, except when more rigid requirements are specified in the Contract Documents, or are required by applicable codes.
- B. Contractor shall conform to current reference standard publication date in effect on the date of bid opening.
- C. Contractor shall obtain copies of standards unless specifically required not to by the Contract Documents.
- D. Contractor shall maintain a copy of all standards at jobsite during submittals, planning, and progress of the specific Work, until final completion, unless specifically required not to by the Contract Documents.
- E. Should specified reference standards conflict with Contract Documents, Contractor shall request clarification from the District and/or the Architect before proceeding.
- F. The contractual relationship of the parties to the Contract shall not be altered from the contractual relationship as indicated in the Contract Documents by mention or inference otherwise in any referenced document.
- G. Governing Codes shall be as shown in the Contract Documents including, without limitation, the Specifications.

END OF SECTION

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SECTION 01 42 19 - REFERENCES

PART 1 - GENERAL

1.01 1.01 SCHEDULE OF REFERENCES:

The following information is intended only for the general assistance of the Contractor, and the District does not represent that all of the information is current. It is the Contractor's responsibility to verify the correct information for each of the entities listed.

AA	Aluminum Association 1525 Wilson Blvd., Suite 600 Arlington, VA 22209 www.aluminum.org	703/358-2960
AABC	Associated Air Balance Council 1518 K Street, NW, Suite 503 Washington, DC 20005 www.aabchq.com	202/737-0202
AAMA	American Architectural Manufacturers Association 1827 Walden Office Sq., Suite 550 Schaumburg, IL 60173-4268 www.aamanet.org	847/303-5664
AASHTO	American Association of State Highway and Transportation Officials 444 N Capitol St. NW - Suite 249 Washington, DC 20001 www.transportation.org	202/624-5800
AATCC	American Association of Textile Chemists and Colorists P.O. Box 12215 One Davis Drive Research Triangle Park, NC 27709 2215 www.aatcc.org	919/549-8141
ACA	American Coatings Association 1500 Rhode Island Ave., NW Washington DC, 20005 www.paint.org	202/462-6272

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ACI	American Concrete Institute 38800 Country Club Dr. Farmington Hills, MI 48331-3439 www.aci-int.org	248/848-3700
ACPA	American Concrete Pipe Association 8445 Freeport Parkway, Suite 350 Irving, TX 75063-2595 www.concrete-pipe.org	972/506-7216
ADC	Air Diffusion Council 1901 N. Roselle Road, Suite 800 Schaumburg, Illinois 60195 www.flexibleduct.org	847/706-6750
AF&PA	American Forest and Paper Association 1111 Nineteenth Street, NW, Suite 800 Washington, DC 20036 www.afandpa.org	202/463-2700
AGA	American Gas Association 400 North Capitol Street, NW Washington, DC 20001 www.aga.org	202/824-7000
AGC	Associate General Contractors of America 2300 Wilson Blvd., Suite 400 Arlington, VA 22201 www.agc.org	703/548-3118
AHA	American Hardboard Association 1210 West Northwest Highway Palatine, IL 60067 www.domensino.com/AHA/default.htm	847/934-8800
AI	Asphalt Institute 2696 Research Park Drive Lexington, KY 40511-8480 www.asphaltinstitute.org	859/288-4960
AIA	The American Institute of Architects 1735 New York Ave., NW Washington, DC 20006-5292 www.aia.org	202/626-7300
AISC	American Institute of Steel Construction One East Wacker Drive Suite 700 Chicago, IL 60601-1802 www.aisc.org	312.670.2400

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AIA	American Insurance Association (formerly the National Board of Fire Underwriters) 2101 L Street, NW, Suite 400 Washington, DC 20037 www.aiadc.org	202/828-7100
AISI	American Iron and Steel Institute 25 Massachusetts Ave., NW, Suite 800 Washington, DC 20001 www.steel.org	202/452.7100
AITC	American Institute of Timber Construction 7012 S. Revere Parkway Suite 140 Centennial, CO 80112 www.aitc-glulam.org	303/792.9559
ALI	Associated Laboratories, Inc. P.O. Box 152837 Dallas, TX 75315 www.assoc-labs.com	214/565-0593
ALSC	American Lumber Standards Committee, Inc. P.O. Box 210 Germantown, MD 20875 www.alsc.org	301/972-1700
AMCA	Air Movement and Control Association International, Inc. 30 W. University Drive Arlington Heights, IL 60004 www.amca.org	847/394-0150
ANLA	American Nursery & Landscape Association 1200 G Street NW, Suite 800 Washington, DC 20005 www.anla.org	202/789-2900
ANSI	American National Standards Institute 1899 L Street, NW, 11th Floor Washington, DC, 20036 www.ansi.org	202/293.8020
APA	APA-The Engineered Wood Association 7011 S. 19th Street Tacoma, WA 98466-5333 www.apawood.org	253/565-6600

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APA	Architectural Precast Association 6710 Winkler Road, Suite 8 Fort Myers, Florida 33919 www.archprecast.org	239/454-6989
ARI	Air Conditioning and Refrigeration Institute 4100 N. Fairfax Drive, Suite 200 Arlington, VA 22203 www.lightindustries.com/ARI	703/524-8800
ARMA	Asphalt Roofing Manufacturers Association Public Information Department 750 National Press Building 529 14th Street, NW Washington, DC 20045 www.asphaltroofing.org	202/591-2450
ASA	The Acoustical Society of America ASA Office Manager Suite 1NO1 2 Huntington Quadrangle Melville, NY 11747-4502 http://asa.aip.org	516/576-2360
ASCE	American Society of Civil Engineers 1801 Alexander Bell Drive Reston, VA 20191 www.asce.org	800/548-2723 703/295-6300
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 1791 Tullie Circle, NE Atlanta, GA 30329-2305 www.ashrae.org	800/527-4723 404/636-8400
ASLA	American Society of Landscape Architects 636 Eye Street, NW Washington, DC 20001-3736 www.asla.org	202/898-2444
ASME	American Society of Mechanical Engineers Three Park Avenue New York, NY 10016-5990 www.asme.org	800/434-2763
ASPE	American Society of Plumbing Engineers 2980 S River Rd. Des Plaines, IL 60018 http://aspe.org	847/296-0002

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ASQ	American Society for Quality P.O. Box 3005 Milwaukee, WI 53201-3005 or 600 North Plankinton Avenue Milwaukee, WI 53203 http://asq.org	800/248-1946 414/272-8575
ASSE	American Society of Sanitary Engineering 901 Canterbury, Suite A Westlake, Ohio 44145 www.asse-plumbing.org	440/835-3040
ASTM	ASTM International 100 Barr Harbor Drive PO Box C700 West Conshohocken, PA, 19428-2959 www.astm.org	610/832-9500
AWCI	Association of the Wall and Ceiling Industry 513 West Broad Street, Suite 210 Falls Church, VA 22046 www.awci.org	703/538-1600
AWPA	American Wood Protection Association P.O. Box 361784 Birmingham, AL 35236-1784 www.awpa.com	205/733-4077
AWPI	American Wood Preservers Institute 2750 Prosperity Ave. Suite 550 Fairfax, VA 22031-4312 www.arcat.com	800/356-AWPI 703/204-0500
AWS	American Welding Society 8669 Doral Boulevard, Suite 130 Doral, Florida 33166 www.aws.org	800/443-9353 305/443-9353
AWI	Architectural Woodwork Institute 46179 Westlake Drive, Suite 120 Potomac Falls, VA 20165-5874 www.awinet.org	571/323-3636
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235 www.awwa.org	800/926-7337 303/794 7711

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BHMA	Builders Hardware Manufacturers Association 355 Lexington Avenue, 15th floor New York, NY 10017 www.buildershardware.com	212/297-2122
BIA	The Brick Industry Association 1850 Centennial Park Drive, Suite 301 Reston, VA 20191 www.gobrick.com	703/620-0010
CGA	Compressed Gas Association 14501 George Carter Way, Suite 103 Chantilly VA 20151-2923 www.cganet.com	703/788-2700
CISCA	Ceilings & Interior Systems Construction Association 1010 Jorie Blvd, Suite 30 Oak Brook, IL 60523 www.cisca.org	630/584-1919
CISPI	Cast Iron Soil Pipe Institute 1064 Delaware Avenue SE Atlanta, GA 30316 www.cispi.org	404/622-0073
CLFMI	Chain Link Fence Manufacturers Institute 10015 Old Columbia Road, Suite B-215 Columbia, MD 21046 www.associationsites.com/main-pub.cfm?usr=clfma	410/290-6267
CPA	Composite Panel Association 19465 Deerfield Avenue, Suite 306 Leesburg, VA 20176 www.compositepanel.org	703/724-1128
CPSC	Consumer Product Safety Commission 4330 East West Highway Bethesda, MD 20814 www.cpsc.gov	301/504-7923 800/638-2772
CRA	California Redwood Association 405 Enfrente Drive, Suite 200 Novato, CA 94949 www.calredwood.org	415/382-0662

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CRI	Carpet and Rug Institute P.O. Box 2048 Dalton, Georgia 30722-2048 www.carpet-rug.org	706/278-3176
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Road Schaumburg, IL 60173 4758 www.crsi.org	847/517-1200
CSI	The Construction Specifications Institute 110 South Union Street, Suite 100 Alexandria VA 22314 www.csinet.org	800/689-2900
CTIOA	Ceramic Tile Institute of America 12061 Jefferson Blvd. Culver City, CA 90230-6219 www.ctioa.org	310/574-7800
DHI	Door and Hardware Institute (formerly National Builders Hardware Association) 14150 Newbrook Dr. Chantilly, VA 20151 www.dhi.org	703/222-2010
DIPRA	Ductile Iron Pipe Research Association 2000 2nd Avenue, South Suite 429 Birmingham, AL 35233 www.dipra.org	205/402-8700
DOC	U.S. Department of Commerce 1401 Constitution Ave., NW Washington, D.C. 20230 www.commerce.gov	202/482-2000
DOT	U.S. Department of Transportation 1200 New Jersey Avenue, SE Washington, DC 20590 www.dot.gov	855/368-4200
EJMA	Expansion Joint Manufacturers Association, Inc. 25 North Broadway Tarrytown, NY 10591 www.ejma.org	914/332-0040

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EPA	Environmental Protection Agency Ariel Rios Building 1200 Pennsylvania Avenue, N.W. Washington, DC 20460 www.epa.gov	202/272-0167
FCICA	Floor Covering Installation Contractors Association 7439 Millwood Drive West Bloomfield, MI 48322 www.fcica.com	248/661-5015 877/TO-FCICA
FM Global	Factory Mutual Insurance Company Amy Daley Global Practice Leader – Education, Public Entities, Health Care FM Global 270 Central Avenue Johnston, RI 02919-4949 www.fmglobal.com	401/275-3000 401/275-3029
FS	General Services Administration (GSA) Index of Federal Specifications, Standards and Commercial Item Descriptions 470 East L'Enfant Plaza, SW, Suite 8100 Washington, DC 20407 www.gsa.gov	202/619-8925
GA	The Gypsum Association 6525 Belcrest Road, Suite 480 Hyattsville, MD 20782 www.gypsum.org	301/277-8686
GANA	Glass Association of North America 800 SW Jackson St., Suite 1500 Topeka, KS 66612-1200 www.glasswebsite.com	785/271-0208
HMA	Hardwood Manufacturers Association 665 Rodi Road, Suite 305 Pittsburgh, PA 15235 http://hmamembers.org	412/244-0440
HPVA	Hardwood Plywood & Veneer Association 1825 Michael Faraday Drive Reston, Virginia 20190 www.hpva.org	703/435-2900

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IAPMO	International Association of Plumbing and Mechanical Officials (formerly the Western Plumbing Officials Association) 4755 E. Philadelphia St. Ontario, CA 91761 www.iapmo.org	909/472-4100
ICC	International Code Council 500 New Jersey Avenue, NW, 6th Floor Washington, DC 20001 www.iccsafe.org	888/422-7233
IEEE	Institute of Electrical and Electronics Engineers 3 Park Avenue, 17th Floor New York, NY 10016-5997 www.ieee.org	212/419-7900
IES	Illuminating Engineering Society 120 Wall Street, Floor 17 New York, NY 10005-4001 www.ies.org	212/248-5000
ITRK	Intertek Testing Services 3933 US Route 11 Cortland, NY 13045 www.intertek.com	607/753-6711
MCAA	Mechanical Contractors Association of America 1385 Piccard Drive Rockville, MD 20850 www.mcaa.org	301/869-5800
MIA	Marble Institute of America 28901 Clemens Rd, Ste 100 Cleveland, OH 44145 www.marble-institute.com	440/250-9222
MMPA (formerly WMMPA)	Moulding & Millwork Producers Association (formerly Wood Moulding & Millwork Producers Association) 507 First Street Woodland, CA 95695 www.wmmpa.com	530/661-9591 800/550-7889

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MSS	Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry 127 Park Street, NE Vienna, VA 22180-4602 http://mss-hq.org	703/281-6613
NAAMM	National Association of Architectural Metal Manufacturers 800 Roosevelt Rd. Bldg. C, Suite 312 Glen Ellyn, IL 60137 www.naamm.org	630/942-6591
NAIMA	North American Insulation Manufacturers Association 44 Canal Center Plaza, Suite 310 Alexandria, VA 22314 www.naima.org	703/684-0084
NAPA	National Asphalt Pavement Association 5100 Forbes Blvd. Lanham, MD USA 20706-4407 www.asphaltpavement.org	888/468-6499 301/731-4748
NCSPA	National Corrugated Steel Pipe Association 14070 Proton Road, Suite 100 LB9 Dallas, TX 75244 www.ncspa.org	972/850-1907
NCMA	National Concrete Masonry Association 13750 Sunrise Valley Drive Herndon, VA 20171-4662 www.ncma.org	703/713-1900
NEBB	National Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877 www.nebb.org	301/977-3698
NECA	National Electrical Contractors Association 3 Bethesda Metro Center, Suite 1100 Bethesda, MD 20814 www.necanet.org	301/657-3110
NEMA	National Electrical Manufacturers Association 1300 North 17th Street, Suite 1752 Rosslyn, Virginia 22209 www.nema.org	703/841-3200

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NEII	National Elevator Industry, Inc. 1677 County Route 64 P.O. Box 838 Salem, New York 12865-0838 www.neii.org	518/854-3100
NFPA	National Fire Protection Association 1 Batterymarch Park Quincy, Massachusetts USA 02169-7471 www.nfpa.org	617/770-3000
NHLA	National Hardwood Lumber Association PO Box 34518 Memphis, TN 38184 www.nhla.com	901/377-1818
NIA	National Insulation Association 12100 Sunset Hills Road, Suite 330 Reston, VA 20190 www.insulation.org	703/464-6422
NRCA	National Roofing Contractors Association 10255 W. Higgins Road, Suite 600 Rosemont, IL 60018-5607 www.nrca.net	847/299-9070
NSF	NSF International P.O. Box 130140 789 N. Dixboro Road Ann Arbor, MI 48113-0140, USA www.nsf.org	800/673-6275 734/769-8010
NTMA	National Terrazzo and Mosaic Association PO Box 2605 Fredericksburg, TX 78624 www.ntma.com	800/323-9736
OSHA	Occupational Safety and Health Act U.S. Department of Labor Occupational Safety & Health Administration 200 Constitution Ave., NW Washington, D.C. 20210 www.osha.gov	800/321-OSHA (6742)
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077 or 500 New Jersey Ave., N.W. 7 th Floor Washington, D.C. 20001 www.cement.org	847/966-6200 202/408-9494

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PCI	Precast/Prestressed Concrete Institute 200 W. Adams St. #2100 Chicago, IL 60606 www.pci.org	312/786-0300
PDCA	Painting and Decorating Contractors of America 2316 Millpark Drive, Ste 220 Maryland Heights, MO 63043 www.pdca.com	800/332-PDCA (7322) 314/514-7322
PDI	Plumbing & Drainage Institute 800 Turnpike Street, Suite 300 North Andover, MA 01845 http://pdionline.org	978/557-0720 800/589-8956
PEI	Porcelain Enamel Institute, Inc. P.O. Box 920220 Norcross, GA 30010 www.porcelainenamel.com	770/676-9366
PG&E	Pacific Gas & Electric Company www.pge.com	800/743-5000
PLANET	Professional Landcare Network 950 Herndon Parkway, Suite 450 Herndon, Virginia 20170 www.landcarenetwork.org	703/736-9666 800/395-2522 703/736-9668
RFCI	Resilient Floor Covering Institute 115 Broad Street, Suite 201 La Grange GA 30240 www.rfci.com	706/882-3833
RIS	Redwood Inspection Service 818 Grayson Road, Suite 201 Pleasant Hill, CA 94523 www.redwoodinspection.com	925/935-1499
SDI	Steel Deck Institute P.O. Box 25 Fox River Grove, IL 60021 www.sdi.org	847/458-4647
SDI	Steel Door Institute 30200 Detroit Road Westlake, Ohio 44145 www.steeldoor.org	440/899-0010
SJI	Steel Joist Institute 234 W. Cheves Street Florence, SC 29501 http://steeljoist.org	843/407-4091

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SMA	Stucco Manufacturers Association 500 East Yale Loop Irvine, CA 92614 www.stuccomfgassoc.com	949/387.7611
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 4201 Lafayette Center Drive Chantilly, Virginia 20151-1219 www.smacna.org	703/803-2980
SPI	SPI: The Plastics Industry Trade Association, Inc. 1667 K St., NW, Suite 1000 Washington, DC 20006 www.plasticsindustry.org	202/974-5200
SSPC	Society for Protective Coatings (formerly the Steel Structures Painting Council) 40 24th St 6th Fl Pittsburgh, PA 15222 www.sspc.org	412/281-2331 877/281-7772
TCA	The Tile Council of North America 100 Clemson Research Blvd. Anderson, SC 29625 www.tcnatile.com	864/646-8453
TPI	Truss Plate Institute 218 North Lee Street, Suite 312 Alexandria, VA 22314 www.tpinst.org	703/683-1010
TPI	Turfgrass Producers International 2 East Main Street East Dundee, IL 60118 www.turfgrasssod.org	800/405-8873 847/649-5555
TCIA	Tree Care Industry Association (formerly the National Arborist Association) 136 Harvey Road, Suite 101 Londonderry, NH 03053 www.tcia.org	800/733-2622
TVI	The Vermiculite Institute c/o The Schundler Company 150 Whitman Avenue Edison, NJ. 08817 www.vermiculiteinstitute.org	732/287-2244
UL	Underwriters Laboratories Inc. 333 Pfingsten Road Northbrook, IL 60062-2096 www.ul.com	847/272-8800 877/854-3577

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UNI	Uni-Bell PVC Pipe Association 2711 LBJ Freeway, Suite 1000 Dallas, TX 75234 www.uni-bell.org	972/243-3902
USDA	U.S. Department of Agriculture 1400 Independence Ave., S.W. Washington, DC 20250 www.usda.gov	202/720-2791
WA	Wallcoverings Association 401 North Michigan Avenue Suite 2200 Chicago, IL 60611 www.wallcoverings.org	312/321-5166
WCLIB	West Coast Lumber Inspection Bureau P.O. Box 23145 Portland, OR 97281 or 6980 S.W. Varns Tigard, OR 97223 www.wclib.org	503/639-0651
WCMA	Window Covering Manufacturers Association 355 Lexington Avenue 15th Floor New York, New York 10017 www.wcmanet.org	212/297-2122
WDMA	Window & Door Manufacturers Association 401 N. Michigan Avenue, Suite 2200 Chicago, IL 60611 or 2025 M Street, NW, Ste. 800 Washington, D.C. 20036-3309 www.wdma.com	312/321-6802 202/367-1157
WI	Woodwork Institute P.O. Box 980247 West Sacramento, CA 95798 www.wicnet.org	916/372-9943
WRI	Wire Reinforcement Institute 942 Main Street Hartford, CT 06103 www.wirereinforcementinstitute.org	860/240-9545
WWCA	Western Wall & Ceiling Contractors Association 1910 N. Lime St. Orange, California 92865 www.wwcca.org	714/221-5520

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WWPA	Western Wood Products Association 522 SW Fifth Ave., Suite 500 Portland, OR 97204-2122 www2.wwpa.org	503/224-3930
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PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

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SECTION 01 43 00 - MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Purchase of Materials and Equipment;
- B. Special Conditions;
- C. Imported Materials Certification.

1.02 MATERIAL AND EQUIPMENT

- A. Only items approved by the District and/or Architect shall be used.
- B. Contractor shall submit lists of products and other product information in accordance with the Contract Documents, including, without limitation, the provisions regarding the submittals.

1.03 MATERIAL AND EQUIPMENT COLORS

- A. The District and/or Architect will provide a schedule of colors.
- B. No individual color selections will be made until after approval of all pertinent materials and equipment and after receipt of appropriate samples in accordance with the Contract Documents, including, without limitation, the provisions regarding the submittals.
- C. Contractor shall request priority in writing for any item requiring advance ordering to maintain the approved Construction Schedule.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall deliver manufactured materials in original packages, containers, or bundles (with seals unbroken), bearing name or identification mark of manufacturer.
- B. Contractor shall deliver fabrications in as large assemblies as practicable; where specified as shop-primed or shop-finished, package or crate as required to preserve such priming or finish intact and free from abrasion.
- C. Contractor shall store materials in such a manner as necessary to properly protect them from damage. Materials or equipment damaged by handling, weather, dirt, or from any other cause will not be accepted.
- D. Materials are not acceptable that have been warehoused for long periods of time, stored or transported in improper environment, improperly packaged, inadequately labeled, poorly protected, excessively shipped, deviated from normal distribution pattern, or reassembled.

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- E. Contractor shall store material so as to cause no obstructions of sidewalks, roadways, access to the Site or buildings, and underground services. Contractor shall protect material and equipment furnished under Contract.
- F. Contractor may store materials on Site with prior written approval by the District, all material shall remain under Contractor's control and Contractor shall remain liable for any damage to the materials. Should the Project Site not have storage area available, the Contractor shall provide for off-site storage at a bonded warehouse and with appropriate insurance coverage at no cost to District.
- G. When any room in Project is used as a shop or storeroom, the Contractor shall be responsible for any repairs, patching, or cleaning necessary due to that use. Location of storage space shall be subject to prior written approval by District.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers listed in various sections of Contract Documents are names of those manufacturers that are believed to be capable of supplying one or more of items specified therein.
- B. The listing of a manufacturer does not imply that every product of that manufacturer is acceptable as meeting the requirements of the Contract Documents.

2.02 FACILITIES AND EQUIPMENT

Contractor shall provide, install, maintain, and operate a complete and adequate facility for handling, the execution, disposal, and distribution of material and equipment as required for proper and timely performance of Work connected with Contract.

2.03 MATERIAL REFERENCE STANDARDS

Where material is specified solely by reference to "standard specifications" and if requested by District, Contractor shall submit for review data on actual material proposed to be incorporated into Work of Contract listing name and address of vendor, manufacturer, or producer, and trade or brand names of those materials, and data substantiating compliance with standard specifications.

PART 3 - EXECUTION

3.01 WORKMANSHIP

- A. Where not more specifically described in any other Contract Documents, workmanship shall conform to methods and operations of best standards and accepted practices of trade or trades involved and shall include items of fabrication, construction, or installation regularly furnished or required for completion (including finish and for successful operation, as intended).
- B. Work shall be executed by tradespersons skilled in their respective lines of Work. When completed, parts shall have been durably and substantially built and present a neat appearance.

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3.02 COORDINATION

- A. Contractor shall coordinate installation of Work so as to not interfere with installation of others. Adjustment or rework because of Contractor's failure to coordinate will be at no additional cost to District.
- B. Contractor shall examine in-place work for readiness, completeness, fitness to be concealed or to receive other work, and in compliance with Contract Documents. Concealing or covering Work constitutes acceptance of additional cost which will result should in-place Work be found unsuitable for receiving other Work or otherwise deviating from the requirements of the Contract Documents.

3.03 COMPLETENESS

Contractor shall provide all portions of the Work, unless clearly stated otherwise, installed complete and operational with all elements, accessories, anchorages, utility connections, etc., in manner to assure well-balanced performance, in accordance with manufacturer's recommendations and by Contract Documents. For example, electric water coolers require water, electricity, and drain services; roof drains require drain system; sinks fit within countertop, etc. Terms such as "installed complete," "operable condition," "for use intended," "connected to all utilities," "terminate with proper cap," "adequately anchored," "patch and refinish," "to match similar," should be assumed to apply in all cases, except where completeness of functional or operable condition is specifically stated as not required.

3.04 APPROVED INSTALLER OR APPLICATOR

Installation by a manufacturer's approved installer or applicator is an understood part of Specifications and only approved installer or applicator is to provide on-site Work where specified manufacturer has on-going program of approving (i.e. certifying, bonding, re-warranting) installers or applicators. Newly established relationships between a manufacturer and an installer or applicator who does not have other approved applicator work in progress or completed is not approved for this Project.

3.05 MANUFACTURER'S RECOMMENDATIONS

All installations shall be in accordance with manufacturer's published recommendations and specific written directions of manufacturer's representative. Should Contract Documents differ from recommendations of manufacturer or directions of his representative, Contractor shall analyze differences, make recommendations to the District and the Architect in writing, and shall not proceed until interpretation or clarification has been issued by the District and/or the Architect.

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SECTION 01 45 00 - QUALITY CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Inspector, Inspections and Tests, Uncovering of Work and Non-conforming of Work and Correction of Work;
- B. Special Conditions.

1.02 RELATED CODES:

- A. The Work is governed by requirements of Title 24, California Code of Regulations ("CCR"), and the Contractor shall keep a copy of these available at the job Site for ready reference during construction.
- B. The Division of the State Architect ("DSA") shall be notified at or before the start of construction.
- C. Project Inspector and testing lab must be employed by the Owner and approved by A/E of Record, Structural Engineer, and DSA.

1.03 OBSERVATION AND SUPERVISION:

- A. The District and Architect or their appointed representatives will review the Work and the Contractor shall provide facilities and access to the Work at all times as required to facilitate this review. Administration by the Architect and any consulting Structural Engineer will be in accordance with applicable regulations, including, without limitation, CCR, Part 1, Title 24, Section 4-341.
- B. One or more Project Inspector(s) approved by DSA and employed by or in contract with the District, referred to hereinafter as the "Project Inspector", will observe the work in accordance with CCR, Part 1, Title 24, Sections 4-333(b) and 4-342:
 - (1) The Project Inspector and Special Inspector(s) shall have access to the Work wherever it is in preparation or progress for ascertaining that the Work is in accordance with the Contract Documents and all applicable code sections. The Contractor shall provide facilities and operation of equipment as needed, and access as required and shall provide assistance for sampling or measuring materials.
 - (2) The Project Inspector will notify the District and Architect and call the attention of the Contractor to any observed failure of Work or material to conform to Contract Documents.
 - (3) The Project Inspector shall observe and monitor all testing and inspection activities required.

The Contractor shall conform with all applicable laws as indicated in the Contract Documents, including, without limitation, to CCR, Part 1, Title 24, Section 4-343. The Contractor shall

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supervise and direct the Work and maintain a competent superintendent on the job who is authorized to act in all matters pertaining to the Work. The Contractor's superintendent shall also inspect all materials, as they arrive, for compliance with the Contract Documents. Contractor shall reject defective Work or materials immediately upon delivery or failure of the Work or material to comply with the Contract Documents. The Contractor shall submit verified reports as indicated in the Contract Documents, including, without limitation, the Specifications and as required by Part 1, Title 24, Section 4-336.

1.04 TESTING AGENCIES:

- A. Testing agencies and tests shall be in conformance with the General Documents and the requirements of Part 1, Title 24, Section 4- 335.
- B. Testing and inspection in connection with earthwork shall be under the direction of the District's consulting soils engineer, if any, referred to hereinafter as the "Soils Engineer."
- C. Testing and inspection of construction materials and workmanship shall be performed by a qualified laboratory, referred to hereinafter as the "Testing Laboratory." The Testing Laboratory shall be under direction of an engineer registered in the State of California, shall conform to requirements of ASTM E329, and shall be employed by or in contract with the District.

1.05 TESTS AND INSPECTIONS:

- A. The Contractor shall be responsible for notifying the District and Project Inspector of all required tests and inspections. Contractor shall notify the District and Project Inspector at least seventy-two hours (72) hours in advance of performing any Work requiring testing or inspection.
- B. The Contractor shall provide access to Work to be tested and furnish incidental labor, equipment, and facilities to facilitate all inspections and tests.
- C. The District will pay for first inspections and tests required by the "CCR", and other inspections or tests that the District and/or the Architect may direct to have made, including the following principal items:
 - (1) Tests and observations for earthwork and paving.
 - (2) Tests for concrete mix designs, including tests of trial batches.
 - (3) Tests and inspections for structural steel work.
 - (4) Field tests for framing lumber moisture content.
 - (5) Additional tests directed by the District that establish that materials and installation comply with the Contract Documents.
 - (6) Tests and observations of welding and expansion anchors.
- D. The District may at its discretion, pay and then back charge the Contractor for:
 - (1) Retests or reinspections, if required, and tests or inspections required due to Contractor error or lack of required identifications of material.

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- (2) Uncovering of work in accordance with Contract Documents.
- (3) Testing done on weekends, holidays, and overtime will be chargeable to the Contractor for the overtime portion.
- (4) Testing done off Site.

E. Testing and inspection reports and certifications:

- (1) If initially received by Contractor, Contractor shall provide to each of the following a copy of the agency or laboratory report of each test or inspection or certification.
 - (a) The District;
 - (b) The Construction Manager, if any;
 - (c) The Architect;
 - (d) The Consulting Engineer, if any;
 - (e) Other engineers on the Project, as appropriate;
 - (f) The Project Inspector; and
 - (g) The Contractor.
- (2) When the test or inspection is one required by the CCR, a copy of the report shall also be provided to the DSA.

PART 2 - PRODUCTS

2.01 TYPE OF TESTS AND INSPECTIONS:

- A. Contractor shall refer to DSA Form 103 (or current version) for all required inspections.
- B. Contractor shall schedule a meeting prior to the commencement of any major construction activities to review DSA Form 103 with the Inspector of Record (IOR), Special Inspection Agency and Construction Manager.

PART 3 - EXECUTION – NOT USED

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SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions;
- C. Site Standards; and
- D. Construction Waste Management and Disposal. Refer to Specification Section 01 74 19.

1.02 TEMPORARY UTILITIES:

- A. Electric Power and Lighting:
 - (1) Contractor will pay for power during the course of the Work. To the extent power is available in the building(s) or on the Site, Contractor may use the District's existing utilities by making prearranged payments to the District for the utilities used by Contractor and all Subcontractors. Contractor shall be responsible for providing temporary facilities required to deliver that power service from its existing location in the building(s) or on the Site to point of intended use.
 - (2) Contractor shall verify characteristics of power available in building(s) or on the Site. Contractor shall take all actions required to make modifications where power of higher voltage or different phases of current are required. Contractor shall be fully responsible for providing that service and shall pay all costs required therefor.
 - (3) Contractor shall furnish, wire for, install, and maintain temporary electrical lights wherever it is necessary to provide illumination for the proper performance and/or observation of the Work: a minimum of 20 foot-candles for rough work and 50 foot-candles for finish work.
 - (4) Contractor shall be responsible for maintaining existing lighting levels in the project vicinity should temporary outages or service interruptions occur.
- B. Heat and Ventilation:
 - (1) Contractor shall provide temporary heat to maintain environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for the installation and curing of materials, and to protect materials and finishes from damage due to improper temperature and humidity conditions. Portable heaters shall be standard units complete with controls.
 - (2) Contractor shall provide forced ventilation and dehumidification, as required, of enclosed areas for proper installation and curing of materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors, and gases.

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- (3) Contractor shall pay the costs of installation, maintenance, operation, and removal of temporary heat and ventilation, including costs for fuel consumed, required for the performance of the Work.

C. Water:

- (1) Contractor shall pay for water used during the course of the Work. Contractor shall coordinate and pay for installation or use of water meter in compliance with local water agency requirements. To the extent water is then available in the building(s) or on the Site, Contractor may use the District's existing utilities by making prearranged payments to the District for the utilities used by Contractor and all Subcontractors. Contractor shall be responsible for providing temporary facilities required to deliver such utility service from its existing location in the building(s) on the Site, or other location approved by the local water agency, to point of intended use.
- (2) Contractor shall use backflow preventers on water lines at point of connection to District's water supply. Backflow preventers shall comply with requirements of Uniform Plumbing Code.
- (3) Contractor shall make potable water available for human consumption.

D. Sanitary Facilities:

- (1) Contractor shall provide sanitary temporary facilities in no fewer numbers than required by law and such additional facilities as may be directed by the Inspector for the use of all workers. The facilities shall be maintained in a sanitary condition at all times and shall be left at the Site until removal is directed by the Inspector or Contractor completes all other work at the Site.
- (2) Use of toilet facilities in the Work under construction shall not be permitted except by consent of the Inspector and the District.

E. Telephone Service:

- (1) Contractor shall arrange with local telephone service company for telephone service as required for the performance of the Work. Contractor shall, at a minimum, provide in its field office one line for telephone and one line for fax machine.
- (2) Contractor shall pay the costs for telephone and fax lines installation, maintenance, service, and removal.

F. Fire Protection:

- (1) Contractor shall provide and maintain fire extinguishers and other equipment for fire protection. Such equipment shall be designated for use for fire protection only and shall comply with all requirements of the California Fire, State Fire Marshall and/or its designee.
- (2) Where on-site welding and burning of steel is unavoidable, Contractor shall provide protection for adjacent surfaces.

G. Trash Removal:

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(1) Contractor shall provide trash removal on a timely basis. Under no circumstance shall Contractor use District trash service.

(2) Refer to Specification Section 01 74 19.

H. Field Office:

(1) If Contractor chooses to provide a field office, it shall be an acceptable construction trailer that is well-lit and ventilated. The construction trailer shall be equipped with shelves, desks, filing cabinet, chairs, and such other items of equipment needed. Trailer and equipment are the property of the Contractor and must be removed from the Site upon completion of the Work.

(2) Contractor shall provide any additional electric lighting and power required for the trailer. Contractor shall make adequate provisions for heating and cooling as required.

(3) Contractor shall provide internet connection.

1.03 CONSTRUCTION AIDS:

A. Plant and Equipment:

(1) Contractor shall furnish, operate, and maintain a complete plant for fabricating, handling, conveying, installing, and erecting materials and equipment; and for conveyances for transporting workers. Include elevators, hoists, debris chutes, and other equipment, tools, and appliances necessary for performance of the Work.

(2) Contractor shall maintain plant and equipment in safe and efficient operating condition. Damages due to defective plant and equipment, and uses made thereof, shall be repaired by Contractor at no expense to the District.

B. None of the District's tools and equipment shall be used by Contractor for the performance of the Work.

1.04 BARRIERS AND ENCLOSURES:

A. Contractor shall obtain the District's written permission for locations and types of temporary barriers and enclosures, including fire-rated materials proposed for use, prior to their installation.

B. Contractor shall provide and maintain temporary enclosures to prevent public entry and to protect persons using other buildings and portions of the Site and/or Premises, the public, and workers. Contractor shall also protect the Work and existing facilities from the elements, and adjacent construction and improvements, persons, and trees and plants from damage and injury from demolition and construction operations.

C. Contractor shall provide site access to existing facilities for persons using other buildings and portions of the Site, the public, and for deliveries and other services and activities.

D. Tree and Plant Protection:

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- (1) Reference Specification Section 01 56 39 – Temporary Tree and Plant Protection.

1.05 SECURITY:

The Contractor shall be responsible for project security for materials, tools, equipment, supplies, and completed and partially completed Work.

1.06 TEMPORARY CONTROLS:

A. Noise Control:

- (1) Contractor acknowledges that adjacent facilities may remain in operation during all or a portion of the Work period, and it shall take all reasonable precautions to minimize noise as required by applicable laws and the Contract Documents.
- (2) Notice of proposed noisy operations, including without limitation, operation of pneumatic demolition tools, concrete saws, and other equipment, shall be submitted to the District a minimum of forty-eight (48) hours in advance of their performance.

B. Noise and Vibration:

- (1) Equipment and impact tools shall have intake and exhaust mufflers.
- (2) Contractor shall cooperate with District to minimize and/or cease the use of noisy and vibratory equipment if that equipment becomes objectionable by its longevity.

C. Dust and Dirt:

- (1) Contractor shall conduct demolition and construction operations to minimize the generation of dust and dirt, and prevent dust and dirt from interfering with the progress of the Work and from accumulating in the Work and adjacent areas including, without limitation, occupied facilities.
- (2) Contractor shall periodically water exterior demolition and construction areas to minimize the generation of dust and dirt.
- (3) Contractor shall ensure that all hauling equipment and trucks carrying loads of soil and debris shall have their loads sprayed with water or covered with tarpaulins, and as otherwise required by local and state ordinance.
- (4) Contractor shall prevent dust and dirt from accumulating on walks, roadways, parking areas, and planting, and from washing into sewer and storm drain lines.

D. Water:

- (1) Contractor shall not permit surface and subsurface water, and other liquids, to accumulate in or about the vicinity of the Premises. Should accumulation develop, Contractor shall control the water or other liquid, and suitably dispose of it by means of temporary pumps, piping, drainage lines, troughs, ditches, dams, or other methods.

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E. Pollution:

- (1) No burning of refuse, debris, or other materials shall be permitted on or in the vicinity of the Premises.
- (2) Contractor shall comply with applicable regulatory requirements and anti-pollution ordinances during the conduct of the Work including, without limitation, demolition, construction, and disposal operations.

F. Lighting:

- (1) If portable lights are used after dark, all light must be located so as not to direct light into neighboring property.

1.07 JOB SIGN(S):

A. General:

- (1) Contractor shall provide and maintain a Project identification sign with the design, text, and colors designated by the District and/or the Design Professional; locate sign as approved by the District.
- (2) Signs other than the specified Project sign and or signs required by law, for safety, or for egress, shall not be permitted, unless otherwise approved in advance by the District.

B. Materials:

- (1) Structure and Framing: Structurally sound, new or used wood or metal; wood shall be nominal 3/4-inch exterior grade plywood.
- (2) Sign Surface: Minimum 3/4-inch exterior grade plywood.
- (3) Rough Hardware: Galvanized.
- (4) Paint: Exterior quality, of type and colors selected by the District and/or the Design Professional.

C. Fabrication:

- (1) Contractor shall fabricate to provide smooth, even surface for painting.
- (2) Size: 4'-0" x 8'-0", unless otherwise indicated.
- (3) Contractor shall paint exposed surfaces of supports, framing, and surface material with exterior grade paint: one coat of primer and one coat of finish paint.
- (4) Text and Graphics: As indicated.

1.08 PUBLICITY RELEASES:

- A. Contractor shall not release any information, story, photograph, plan, or drawing relating information about the Project to anyone, including press and other public communications

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medium, including, without limitation, on website(s) without the written permission of the District.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

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SECTION 01 52 13 - FIELD OFFICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions; and
- C. Temporary Facilities and Controls.

1.2 SECTION INCLUDES:

- A. Requirements for Field Offices and Field Office Trailers.

1.3 SUMMARY:

- A. General: Contractor shall provide District's Field Office Trailer(s) and contents, for District's use exclusively, during the term of the Contract.
- B. Property: Trailer(s), furniture, furnishings, equipment, and the like, supplied by the Contractor with the Office Trailer(s) shall remain the property of the Contractor; District property items installed, delivered, and the like by District within the Office Trailer(s) will remain District's property.
- C. Modifications: District reserves the right to modify the trailer(s) or contents, or both, as may be deemed proper by District.
- D. Condition: Trailers) and contents shall be clean, neat, substantially finished, in good, proper, and safe condition for use, operation, and the like; the trailer(s) and contents shall not be required to be new.
- E. Installation Timing: Provide safe, fully furnished, functional, proper, complete, and finished trailer properly ready for entire use, within fourteen (14) calendar days of District's notification of the issuance of Notice to Proceed.

1.4 SUBMITTALS:

- A. General: Submit submittals to District in quantity, format, type, and the like, as specified herein.
- B. Office Trailer(s) Data: One (1) copy of manufacturer's descriptive data, technical descriptions, regulatory compliance, industry standards, installation, removal, and maintenance instructions.
- C. Equipment Data: Two (2) copies of manufacturer data for each type of equipment, if directed by District.
- D. Furniture and Furnishings Data: Two (2) copies of manufacturer data for each type of equipment, if directed by District.

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- E. Plans: One (1) reproducible copy of appropriately scaled plans of trailer layout. Plans shall include, but not be limited to: lighting; furniture; equipment; telephone and electrical outlets; and the like.
- F. Product Samples: One (1) complete and entire unit of each type, if directed by District.

1.5 QUALITY ASSURANCE

- A. Standards: In the event that provisions of codes, regulations, safety orders, Contract Documents, referenced manufacturer's specifications, manufacturer's instructions, industry standards, and the like, are in conflict, the more restrictive and higher quality shall govern.
- B. Installer: Installer or Installers engaged by Contractor must have a minimum of five (5) years of documented and properly authenticated successful experience of specialization in the installation of the items or systems, or both, specified herein.
- C. Manufacturer: Contractor shall obtain products from nationally and industry recognized Manufacturer with five (5) years minimum, of immediately recent, continuous, documented and properly authenticated successful experience of specialization in the manufacture of the product specified herein.
- D. State Personnel Training: Provide proper training for maintenance and operations, including emergency procedures, and the like, as directed by District.
- E. Units: Shall be sound and free of defects, and shall not include any damage or defect that will impair the safety, installation, performance, or the durability of the entire Office Trailer and appurtenant systems.

1.6 REGULATORY REQUIREMENTS

- A. General: Work shall be executed in accordance with applicable Codes, Regulations, Statutes, Enactments, Rulings, Laws, each authority having jurisdiction, and including, but not limited to, Regulatory Requirements specified herein.
- B. California Building Standards Code ("CBSC").
- C. California Code of Regulations, Title 25, Chapter 3, Sub Chapter 2, Article 3 ("CCR").
- D. Coach Insignia: Trailer shall display California Commercial Coach Insignia; such insignia shall be deemed to show that the trailer is in accordance with the Construction and Fire Safety requirements of CCR.

PART 2 – PRODUCTS

2.1 FIELD OFFICE TRAILERS FOR USE BY THE PROJECT CONSTRUCTION MANAGER AND PROJECT INSPECTOR OF RECORD

- A. General: Provide Field Office Trailer(s) of type, function, operation, capacity, size, complete with controls, safety devices, accessories, and the like, for proper and durable installation. Partitions, walls, ceiling, and other interior and exterior surfaces shall be appropriately finished, including, but not limited to, trim, painting, wall base, floor covering, suspended or similar ceiling, and the like; provide systems, components, units, nuts, bolts, screws, anchoring devices, fastening devices, washers, accessories,

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adhesives, sealants, and other items of type, grade, and class required for the particular use, not identified but required for a complete, weather-tight, appropriately operating, and finished installation.

B. Manufacturers: General Electric Capital Modular Space; The Space Place, Inc.; or equal.

C. Program: Provide a wheel-mounted trailer with stairs, landings, platforms, ramps, and the like, in good, proper, safe, clean, and properly finished condition; with proper heavy-duty locks, and other proper and effective security at all doors, windows, and the like. Trailer shall be maintained in good, proper, safe, clean, and properly finished condition during the Contract.

- (1) Nominal Trailer Size: Must include four (4) lockable offices for Construction Managers and Inspectors of Record, space for six (6) workstation desks, a large central open space in the middle for meeting area, plan tables and racks, storage, and printer equipment. Final floor plan to be reviewed and approved by Construction Manager.
- (2) Stairs, Platform: Properly finished stairs, platforms, and ramps.
- (3) Doors: Two (2), three (3) foot wide exterior doors with locksets; finished ramp, steps, and entry platform at each exterior door.
- (4) Keys: Submit five (5) keys for each door, window, furniture unit, and the like. There shall be no other key copies or originals available; each key shall be identified for District; and shall be labeled, or tagged or both, as directed by District.
- (5) HVAC: HVAC: Heating and Air-Conditioning for the field office capable of maintaining temperatures between 65 and 75 degrees.
- (6) Lighting: Sixty-five (65) foot-candles illumination minimum at any point, at thirty (30) inches above finished floor throughout from fluorescent light source, exclusively, or as directed by District.
- (7) Electrical Outlets: One (1) duplex outlet evenly spaced every twelve (12) linear horizontal feet of wall face, and electrical service ready for use.
- (8) Telephones and Telephone Outlets: Two (2) telephone lines wired, connected to telephone utility service, and ready for use, and two (2) telephone instruments, each with two (2)-line capability, speed dial and hands-free feature. Locate each outlet as directed by District.
- (9) Voicemail Messaging System or Answering Machine: One (1) unit, two (2)-line; digital.
- (10) Data Connection: Contractor should assume that a connection to the local utility provider is required. Provide a router to allow a minimum of six (6) users to connect.

The network shall have the following requirements:

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- (a) The internet connection, if provided by the client or subcontractor, shall have at a minimum a 20-Meg upload / 20-Meg download speed. This should be accomplished via a hard-wired connection.
- (b) If it is necessary to “piggyback” off of an existing hard-wired line, the line provided to Kitchell shall be an unfiltered line, with no limitations set by the main line holder, such as access restrictions or DNS port blocking.
- (c) In the cases where a hard-wired connection is not available, the wireless connection provided must meet the same speed needs of 20-Meg upload / 20-Meg download. It shall also be of sufficient bandwidth to meet the needs of the staff.

The equipment required at the site shall be determined by Kitchell Management. However, for an office of three people or more, Kitchell will require:

- (A) A Cisco ASA 5505 network security appliance.
- (B) A Cisco switch.
- (C) Wired network connections to the workspaces for the Kitchell staff.
- (D) A wired network connection to the Printer/Scanner. Reasonable access to power for the equipment.

2.2 FIELD OFFICE TRAILER ITEMS

- A. General: Provide the Field Office Trailer(s) with the following arranged into Six (6) workstations:
 - (1) Desks: Six (6) desks with lockable file storage: thirty-six (36) inches by sixty (60) inches; steel, laminated plastic top; locking, one (1) or two (2) file drawers single pedestal; steel; provide five (5) keys to District.
 - (2) Tables: Three (3) tables; thirty-six (36) inches by sixty (60) inches; twenty-nine (29) inches high; steel, laminated plastic top tables; one (1) at each desk.
 - (3) Chairs: Six (6) chairs: swivel; steel; with seat cushion and arms; one (1) at each desk. Ten (10) collapsible chairs for Tables.
 - (4) Waste Baskets: Eight (8) waste baskets and 5 (five) recycling baskets. One of each placed at each desk.
- B. Furniture and Equipment: Provide in the space located to effect efficient and logical use.
 - (1) File cabinet: One (1); four (4) drawer; lateral; steel locking.
 - (2) Plan Table: One (1) plan table: thirty-six (36) inches deep by seventy-two (72) inches wide by forty-two (42) inches high; adjustable; wood or steel; with lockable plan and pencil drawers.
 - (3) Drafting Stool: One (1) drafting stool; swiveling; steel; padded; adjustable; with footrest and casters.

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- (4) Bookshelf: One (1) bookshelf: thirty-six (36) inches deep by seventy-two (72) inches wide by forty-two (42) inches high; adjustable; wood or steel; with lockable plan and pencil drawer.
- (5) Plan Rack: One (1) wheel mounted plan rack.
- (6) Waste Baskets: One (1) large waste basket.
- (7) Coat/Hat Hanger: Wall mounted with minimum capacity for four (4) garments and ten (10) hats.
- (8) Document Management System: Shall include an integrated high-volume printer, copier, and facsimile machine, including stand, base, and storage cabinet; and shall include the following features:
 - (a) Type: Laser, dry electrostatic transfer, plain paper, digital, multi-function imaging system.
 - (b) Network: Ethernet or Token Ring network ready, Plug-and-Play.
 - (c) Print, send/receive facsimile from any connected workstation.
 - (d) Resolution: Six hundred (600) dots per inch by six hundred (600) dots per inch, minimum.
 - (e) Print Speed: Twenty (20) pages per minute, minimum.
 - (f) Copies: Twenty (20) copies per minute, minimum.
 - (g) Document Handler: Forty (40) sheet, minimum
 - (h) Collator: Forty (40) bin, minimum, with stapling.
 - (i) Duplexing: Capable.
 - (j) Paper Size: Capable of handling paper sizes to eleven (11) inches by seventeen (17) inches.
 - (k) Paper Cassettes: One (1) each for eight and one half (8.5) inches by eleven (11) inches, eight and one half (8.5) inches by fourteen (14) inches, and eleven (11) inches by seventeen (17) inches paper sizes; minimum two hundred fifty (250) sheets per cassette.
 - (l) Reduction/Enlargement: Capable of reduction to twenty-five percent (25%) and enlargement to two hundred percent (200%).
 - (m) Facsimile Electronic Storage: Capable of storing minimum of fifty (50) speed dial numbers, group faxing and broadcast faxing.
 - (n) Facsimile Scanning: Capable of scanning into memory a minimum of one hundred (100) pages with maximum scan time of three (3) seconds per page.
 - (o) Halftone: Sixty-four (64) levels.

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(p) Redial: Automatic and Manual.

(9) Maintenance: Contractor shall purchase service agreements for each unit of equipment for the duration of the project plus two (2) months, and shall maintain all equipment in proper working condition. Service agreements shall include provision for replacement of toner cartridges and other items required to effect proper unit use. Service agreements shall also provide for:

(a) Unlimited Service Calls.

(b) Same Day Response.

(c) All parts, labor, preventative maintenance and mileage.

(d) All chemicals, such as toner, fixing agent, and the like.

(e) System training and setup.

(10) Provide an office trailer with restroom facilities inside the trailer.

(11) Portable Toilets: Two (2); each shall include a urinal; each unit shall be a properly enclosed chemical unit conforming to ANSI Z4.3.

(a) Location: As directed by District.

(b) Maintenance: Maintain each unit and surrounding areas in a clean, hygienic and orderly manner, at all time. Empty, clean, and sanitize each unit each day at a location and time as directed by District.

(c) Removal: Relocate, or remove from the site, each Portable Toilet. Upon such directive by District, the Contractor shall forthwith relocate or remove each Portable Toilet and submit the affected areas to a condition which existed prior to the installation of each Portable Toilet, within three (3) calendar days, or as directed by District in writing, at no cost to District.

(12) Microwave.

(13) Micro fridge.

2.3 UTILITY AND SERVICES

A. Telephone Service: Contractor shall provide and interface the entire telephone service, and shall properly and timely pay for telephone service for District's non-long-distance use.

B. Electrical Service: Provide all proper connections and continuously pay for service for the duration of the Work.

2.4 FINISHES

A. General: Manufacturer standard finish system over surfaces properly cleaned, pretreated, and prepared to obtain proper bond; all visible surfaces shall be coated.

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- B. Finish: Color as selected by District from manufacturer standard palette.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. General: Properly prepare area and affected items to receive the Work. Set Work accurately in location, alignment, and elevation; rigidly, securely, and firmly anchor to appropriate structure; install plumb, straight, square, level, true, without racking, rigidly anchored to proper solid blocking, substrate, and the like; provide appropriate type and quantity of reinforcements, fasteners, adhesives, self-adhesive and other tapes; lubricants, coatings, accessories, and the like, as required for a complete, structurally rigid, stable, sound, and appropriately finished installation, in accordance with manufacturer's published instructions, and as indicated. The more restrictive and higher quality requirement shall govern. Moving parts shall be properly secured, without binding, looseness, noise, and the like.
- B. Installation: Install in accordance with 25 CCR 3.2.3 and as directed by District; jack up trailer and level both ways; mount on proper concrete piers with all load off wheels; provide required tie down and accessories per Section 4368 of referenced CCR, and as directed by District.
- C. Rejected Work: Work, materials, unit, items, systems, and the like, not accepted by District shall be deemed rejected, and shall forthwith be removed and replaced with proper and new Work, materials, unit, items, systems, and the like at no cost to District.
- D. Standard: Comply with manufacturer's published instructions, or with instructions as shown or indicated; the more restrictive and higher quality requirement shall govern.
- E. Location: As directed by District.
- F. Fire Resistance: Construct and install in accordance with UL requirements.
- G. Maintenance: Contractor shall maintain trailer and adjacent areas in a safe, clean and hygienic condition throughout the duration of the Work, and as directed by District. Properly repair or replace furniture or other items, as directed by District. Properly remove unsafe, damaged, or broken furniture, or similar items, and replace with safe and proper items. Contractor shall pay cost of all services, repair, and maintenance, or replacement of each item.
- H. Janitorial Service: Provide professional janitorial services, including, but not limited to, trash, waste paper baskets, fill paper dispensers; clean and dust all furniture, files, and the like; sweep and mop resilient and similar flooring; and vacuum carpeting and similar flooring.
- (1) Frequency: Two (2) times per week, minimum.
- I. Removal: Properly remove the Office Trailer and contents from the Site upon completion of the Contract, or as directed by District in writing. Forthwith properly patch and repair affected areas; replace damaged items with new items. Carefully and properly inventory, clean, pack, store, and protect District property; submit District property to District at a date, time and location as directed by District.

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3.2 RESPONSIBILITY OF EXPENSES

- A. The Field Offices will be installed prior to the start of the Project. Another General Contractor designated by the District will be responsible for acquiring and installing all Products mentioned above.
- B. As of July 1, 2023, all leases associated with the field office trailer(s), furniture, equipment, and utility connections will be transferred to General Contractor from the originating General Contractor. General Contractor must coordinate all lease transfer activities and requirements with the originating General Contractor.
- C. Once lease transfers are completed, General Contractor is responsible for all leases associated with the Field Trailer(s), furniture, equipment, and utility connections and must carry financial responsibility through the completion of the Project.
- D. Expenses shall include:
 - (1) Trailer leases.
 - (2) Furniture, equipment and supplies.
 - (3) Maintenance Service agreements.
 - (4) Utility services and agreements.

END OF SECTION

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SECTION 01 56 39 – TEMPORARY TREE AND PLANT PROTECTION

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes the protection and trimming of existing trees that interfere with, or are affected by execution of the work, whether temporary or permanent construction.
- B. Tree Protection Measures shall be applied to all landscape trees designated for preservation with tree protection fencing as indicated on plans.
 - 1. An independent arborist's report is required prior to final determination of trees to remain. Contractor to engage an independent ISA certified arborist to examine existing trees to be protected under contract for health and structural stability. Arborist shall provide a report with recommendations for tree preservation and/or removal, and for branch and root pruning during construction.
 - 2. Arborist shall submit all communication to the Construction Manager.
- C. All trees to be preserved and protected shall be watered by whatever means necessary with clean potable water to keep the trees in a healthy condition.
- D. Insect and disease control.
- E. Root pruning and tree trimming/pruning.
- F. Protection of any existing irrigation system servicing trees and plants to remain.
- G. Irrigation system servicing trees to remain that will be affected by construction shall be repaired, replaced, or relocated according to the plans, within 20 days of disruption. Temporarily reconnect existing irrigation if necessary to assure uninterrupted watering of trees and plants.
- H. At the end of construction operation, removal and proper disposal of tree protection fencing and other materials installed for and associated with tree and root protection under contract.
 - 1. Mineral and organic mulch to remain on site.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Section 02 14 16 – Building Demolition
 - 2. Section 02 41 13 – Selective Site Demolition
 - 3. Section 02 41 19 – Landscape Selective Demolition
 - 4. Section 03 30 00 – Cast-In-Place Concrete, for footings of adjacent structures
 - 5. Section 31 10 00 – Site Clearing

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6. Section 32 01 90 – Landscape Maintenance, for duration of plant maintenance period.
7. Section 32 12 16 – Asphalt Paving, for adjacent paving
8. Section 32 15 41 – Aggregate Paving with Admixture, for adjacent paving
9. Section 32 84 00 – Irrigation, for sleeving
10. Section 32 91 13 – Soil Preparation, for definitions of soil
11. Section 32 93 00 – Plants, for watering and mulching
12. Section 32 96 00 – Transplanting, for plants to be relocated on site
13. Division – Site Utilities, for trenching and sleeving
14. Section 33 47 27 – Bioretention, for adjacent bioretention areas

1.03 DEFINITIONS

- A. Backfill: For the purposes of planting, excavated or stockpiled native soil mixed with top soil and/or approved soil amendments. Backfill soil shall be clean and free of large stones and roots, plants, sod, clods, clay lumps, pockets of coarse sand, and of suitable moisture content and granular texture for placing around tree rootball. For non-planting related purposes, see Section 31 23 33 – Trenching, Backfilling and Compacting for backfill requirements at utility trenches.
- B. Drip line: is defined as outermost extent of tree canopy, encompassing tree canopy, trunk, roots and soil. In no case shall drip line encompass an area less than a 10 foot diameter circle around tree trunk.
- C. Critical Root Zone: is defined as a minimal distance from the trunk where roots must be protected from construction related activities
- D. Caliper: is the diameter of a trunk measured by a diameter tape at a height of 48 inches above the ground for trees up to and including 4-inch size at this height, and measured at a height of 12 inches above the ground for trees larger than 4-inch size.
- E. Caliper: Diameter of a trunk measured by a diameter tape at a height 48 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.
- F. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape at a height 54 inches above the ground line.
- G. Drainage Fill: 3/4-inch clean drain rock.
- H. Injury: is defined, without limitation, as any bruising, scarring, tearing, or breaking of roots, branches or trunk; or soil compaction or contamination resulting in decline of health of tree.
- I. Planting Area: An area indicated on the plans to be newly planted with trees, shrubs, perennials, vines, grasses and other plants as part of this project.
- J. Planting Soil: Existing on-site soil, topsoil, imported soil, or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth

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- K. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- L. Topsoil: naturally produced and harvested soil from the A horizon or upper layers of soil.
- M. Tree: Single and multi-stemmed plants, including palms with anticipated mature height approximately 25 feet or greater, or any plant identified on the Drawings as a tree.
- N. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise and specifically indicated on Drawings.
- O. Vegetation: Trees, shrubs, groundcovers, grasses, and other plants.

1.04 SUBMITTALS

- A. Tree Protection Fence: 6-foot high chain link panelized temporary fencing. Refer to Drawings.
- B. Tree Pruning Schedule: Written schedule from arborist detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
 - 1. Species and size of tree.
 - 2. Location on site plan. Include unique identifier for each.
 - 3. Reasons for pruning
 - 4. Description of pruning to be performed.
 - 5. Description of maintenance following pruning.
- C. Qualification Data: For tree service firm and arborist.
- D. Arborist Report to include the following:
 - 1. Final determination that trees to be protected under contract are in a healthy condition and will not cause safety issues.
 - 2. Confirmation that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
 - 3. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
- E. Mulch:
 - 1. Submit 1 Quart sample. Clearly identify product type and source.
 - 2. Product data.
 - 3. Refer to Section 32 93 00 – Plants.
- F. Existing Conditions: Documentation of existing trees indicated to remain which establishes pre-construction conditions that might be misconstrued as damage caused by construction activities.
 - 1. Use sufficiently detailed photographs or video recordings. Provide a minimum of one overall photo and two close-up photos of each wound or damage.
 - 2. Identify location of tree or plant on plans.

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3. Include plans and notations to indicate specific wounds and damage conditions of each tree designated to remain.
4. Mark all documentation with date indicating when photographs or videos were taken.

1.05 QUALITY ASSURANCE

- A. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified Arborist to Project site during tree protection and trimming.
- B. Arborist Qualifications: An arborist certified by ISA or licensed in the jurisdiction where Project is located. Acceptable Arborists include but are not limited to:
 1. Steve Batchelder Consulting Arborist, (510) 787-3075
 2. Walter Levison Consulting Arborist, (415) 203-0990
 3. Roy Leggitt, Tree Management Experts, (415) 606-3610
- C. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning)."
- D. Pre-construction Conference: Conduct conference at Project site to review contractor's plan for compliance with specifications in this and related sections.
 1. Before tree protection and trimming operations begin, meet with representatives of authorities having jurisdiction, Owner's Representative, Landscape Architect, consultants, and other concerned entities to review tree protection and trimming procedures and responsibilities.
 2. Review methods and procedures related to temporary tree and plant protection including but not limited to the following:
 - a. Personnel and equipment needed to make progress and avoid delays.
 - b. Arborist's responsibilities.
 - c. Quality control program.
 - d. Coordination of Work and equipment movement within locations of protection zones.
 - e. Trenching by hand or with air spade within protection zones.

1.06 FIELD CONDITIONS

- A. The following are prohibited within protection zones:
 1. Storage of construction materials, debris, or excavated material.
 2. Moving or parking vehicles or equipment.
 3. Foot traffic.
 4. Erection of structures or sheds.
 5. Impoundment of water.
 6. Discarding of cementitious materials, paints, and other chemicals.
 7. Grading, excavation or other digging unless otherwise indicated on Drawings and approved in writing by Landscape Architect.

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8. Attachment of signs or wrapping materials around trees unless otherwise indicated and approved by Landscape Architect.

1.07 APPROVAL OF TRENCHING AND EXCAVATION

- A. The contractor shall obtain written approval from the Landscape Architect and a certified Arborist prior to start of excavation work within the drip line of trees. A Certified Arborist shall be retained as needed to provide written direction at the Contractor's expense.
- B. The Contractor is prohibited from using equipment for trenching and excavation work within the tree drip line or where root intrusion exists on paved pathways to be reconstructed.
- C. In the event pruning is required for roots greater than 2" in diameter, the Contractor shall receive written direction from the Landscape Architect in coordination with Arborist prior to continuation of work.
- D. Do not direct vehicle or equipment exhaust toward plant protection zones.
- E. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

1.08 TRENCHING UNDER LOW BRANCHES

- A. In areas where trenching is required under low hanging tree branches 12 to 20-feet off the ground, the Contractor shall operate equipment to a maximum height of 11-feet to avoid contact and possible damage to the tree branches.
- B. In areas where tree branches hang below 12-feet off the ground over the area to be excavated, the Contractor shall manually excavate the trench.

1.09 NON-APPROVED TRENCHING

- A. In the event trenching or excavation is performed by the Contractor without the necessary approval or as shown on the Drawings, the Contractor shall be subject to a fine of one half day liquidated damages for every 50 feet.
- B. The only exception to paragraph 1.11/A is for trenching to a maximum of 3-feet as measured horizontally without approval at any particular location for the placement of pipe fittings and quick couplers outside the Tree Protection Zone of any tree.

1.10 TRENCHING AND INSTALLATION OF UNDERGROUND UTILITIES NEAR TREE ROOTS

- A. The Contractor shall place all piping 3 1/2-inches and smaller and all conduits a minimum of 18-inch below finish grade. New conduits shall be located at least 25-feet away from all tree trunks, and 5 feet away from and parallel to paths.
- B. The Contractor shall place all piping 4-inches and larger a minimum of 3-feet below the finish grade except when approved by the Landscape Architect to clear root systems. In no case shall

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the 4-inch and larger pipe be placed less than 2 feet below the finish grade. Refer to the drawings for additional information when pipes cross over or under other pipes or conduit.

- C. The Contractor shall not cut any tree roots over 2-inch in diameter unless an approved arborist is consulted. The Contractor shall bend and/or transition underground conduit and piping so that the conduit or piping will thread between tree roots. This 2-inch diameter tree root guideline is dependent of the species of tree. Various trees have a more fibrous root system, consequently, severing a large number of these roots can be as detrimental to certain species of trees as severing a fewer number of larger tree roots.
- D. When possible, do not run trenches on the side of the tree exposed to prevailing winds as roots are primarily anchored on the windward side. Trenches shall not be cut across more than one quadrant of the tree root zone.
- E. Excavated material shall not be deposited under the leaf/needle canopy of established trees. The excavated material shall be placed in piles along one side of a paved surface. In no case shall the Contractor place the excavated material closer than 6-feet from the base of a tree.
- F. The Contractor is responsible for identifying all underground lighting, electrical control, and irrigation utilities within the project site area. Peralta College District will not provide any field marking service, protecting, and warning the Contractor of the underground facilities. As part of the contract work, the Contractor is required to locate, probe, determine, and flag or mark all underground facilities including, but not limited to, metal and plastic conduits and pipelines, sprinkler heads, quick couplers, valves boxes, controller boxes, pull boxes, prior to excavation.
- G. The Contractor shall replace all affected areas with new surfacing within 10 calendar days after beginning trench excavation. All trenches in pathways and planting areas shall be temporarily covered for immediate use. The Contractor shall not accumulate affected areas for group planting or group paving of trench.
- H. The Contractor shall locate quick couplers, mainlines and lateral lines. Obtain the Construction Manager's approval to cap tees located in the field directly under the tree drip line to prevent extensive disturbance to roots.

1.11 DAMAGE TO TREES AND PAYMENT FOR DAMAGE

- A. The Contractor shall replace any trees that suffer serious damage, as determined by Landscape Architect or approved Arborist, including damage to roots 2-inches in diameter or larger, during construction at no additional cost to the Owner.
- B. If the Contractor should cause minor damage as defined by nicked tree trunks, limbs and branches or broken branches to trees during the course of construction, the Contractor shall pay the following penalties at the beginning of each billing period:
 - 1. The Contractor will be penalized the sum of Four Hundred dollars (\$400) for the first incident which causes minor damage to trees.
 - 2. The Contractor will be penalized the sum of Six Hundred dollars (\$600) for the second incident which causes minor damage to trees.

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3. The Contractor will be penalized the sum of Eight Hundred dollars (\$800) for the third and subsequent incidents which cause minor damage to trees.
- C. The Contractor shall replace any trees that suffer more serious damage, including damage to roots 2-inches in diameter or larger, during construction at no additional cost to the Client. The Construction Manager shall determine the value of such replacement trees. In addition to the Contractor's restoration approved by the Construction Manager, the Contractor will be assessed damages for the difference in the dollar value of the damaged tree or other plant material, and the dollar value of the replacement.
 1. The dollar value will be determined by the Construction Manager from the "Guide for Establishing Values of Trees and Other Plants," prepared by the Council of Tree and Landscape Appraisers, current edition. Damages assessed will be deducted from moneys due or that may become due to the Contractor.
- D. The Contractor shall in addition be liable for the cost to the District for removing the damaged tree(s). This cost will cover 1.5 times the hourly wage of all person(s) at the site for the required hours to remove the tree(s) and haul offsite as directed by the Construction Manager.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Backfill Soil: Stockpiled native soil mixed with top soil and/or approved soil amendments of suitable moisture content and granular texture for placing around tree rootball; free of large stones and roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.
 1. Mixture: Well-blended mix of two parts stockpiled soil to one part planting soil.
 2. Planting Soil: Planting soil as specified in Section 32 91 13 "Soil Preparation"
- B. Mulch: Refer to Section 32 93 00 "Plants."
- C. Tree Protection Fence: Fixed in position, one of the following types:
 1. At relatively level conditions, 6-foot high chain link panelized temporary fencing with moveable concrete footings, sturdy, and capable of acting as a barrier against objects, vehicles, etc., and designed so as to allow for access to inside for care of tree as required. It shall be continuously maintained and repaired as necessary. Metal shall be galvanized.
 2. At slopes steeper than 3:1, Plastic Protection-Zone Fencing
 - a.
 - b. Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties;

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and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches apart.

- c. Height: 48 inches.
 - d. Color: High-visibility orange, nonfading.
- D. Protection-Zone Signage: Legibly printed with non-fading lettering and as follows:
- 1. Sign type: Refer to Drawings
 - 2. Text: Refer to Drawings
 - 3. Lettering: 3-inch high minimum black characters on white background.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary Erosion and Sedimentation Control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
 - 1. Refer to Sedimentation and Erosion Control Plan and Section 31 00 00 – Site Clearing and Section 31 25 00 – Erosion and Sedimentation Control.
- B. Prepare written report listing conditions detrimental to tree protection.

3.02 PREPARATION

- A. Temporary Fencing: Protection zone shall be installed continuously around the tree's branched canopy and extending out to each tree's longest dripline radius plus one foot beyond.
 - 1. Install temporary fencing according to manufacturer's written instructions.
 - 2. Install fencing prior to the start of any site preparation work, and maintain in an upright condition. Do not remove until the completion of construction.
- B. Protect tree root systems from damage caused by soil compaction resulting from vehicular traffic, construction equipment, temporary or mobile buildings, supplies, materials driven, parked, stockpiled, or located within the dripline of all trees.
- C. Mulch areas inside tree protection zones and within drip line of trees to remain and other areas indicated.
 - 1. Apply 4-inch average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.
 - 2. If light construction equipment must cross through the critical root zone (i.e. crossing the critical root zone is the only possible path of travel), the entire cartway within the critical root zone shall be protected with an additional 4-inches of organic mulch to a total of 8-inches average thickness, and covered with 1 ½" plywood the entire length of path of travel within the root zone to protect against compaction.

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- D. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, storing or cleaning construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- E. Maintain tree protection zones free of weeds and trash.
- F. Do not allow fires within tree protection zones.
- G. No signs, ropes, cables, or any other items shall be attached to a protected tree, except those cables recommended by a Certified Arborist for limb support.
- H. At pedestrian walkways, construct fences so as not to obstruct safe passage.

3.03 EXCAVATION

- A. Install shoring or other protective supports to minimize sloping or benching of excavations.
- B. Do not excavate within tree protection zones, unless otherwise indicated and approved in writing by Landscape Architect.
- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use clean narrow-tine spading forks and comb soil to expose roots. Notify Landscape Architect where roots are encountered. Follow recommendation of Project Arborist for cutting and treatment of all exposed roots 1" and greater.
 - 1. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction.
 - 2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
- D. Where utility trenches are required within tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.
 - 1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with clean sharp pruning instruments; do not break or chop.

3.04 RE-GRADING

- A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by 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. Cut roots with clean, sharp pruning instruments; do not break or chop.

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- B. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with planting soil. Place soil in a single un-compacted layer and hand grade to required finish elevations.
- C. Moderate Fill: Where existing grade is more than 6 inches but less than 12 inches below elevation of finish grade, place drainage fill and planting soil on existing grade as follows:
 - 1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of finish grade and extend not less than 18 inches from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill up to 6 inches below grade elevation.
 - 2. Place fill layer of soil to finish grade. Do not compact drainage fill or soil. Hand grade to required finish elevations.

3.05 TREE PRUNING

- A. Prune trees to remain that are affected by temporary and permanent construction.
- B. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by approved Arborist.
- C. Pruning Standards: Prune trees according to ANSI A300, Part 1.
- D. Cut branches with clean, sharp pruning instruments; do not break or chop.
- E. Chip removed tree branches and spread over areas identified by the Owner's Representative.

3.06 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to approved Arborist's written instructions.
- B. Remove and replace trees indicated to remain that die or are damaged during construction operations, that approved Arborist determines are incapable of restoring normal growth pattern.
 - 1. Provide new trees of a species selected by Landscape Architect.
 - 2. For small trees with caliper of two (2) inches to eight (8) inches, size of replacement tree shall match the size of tree being replaced. For larger trees with caliper over eight (8) inches, size of replacement tree shall be 60" box.
 - 3. Since age and size of existing tree may prohibit replacement with same size tree, the difference in caliper between size of damaged tree and replacement tree shall be monetarily compensated by the Contractor.
 - 4. Plant and maintain new trees as specified in Section 32 93 00 "Plants."

3.07 TREE REMOVAL

- A. Remove all trees indicated on Drawings as requiring removal, in a manner that will not damage adjacent trees or structures or compacts the soil.

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- B. Remove trees that are adjacent to trees or structures to remain, in sections, to limit the opportunity of damage to adjacent crowns, trunks, ground plane elements and structures.
- C. Do not drop trees with a single cut unless the tree will fall in an area not included in the Tree and Plant Protection Area. No tree to be removed within 50 feet of the Tree and Plant Protection Area shall be pushed over or up-rooted using a piece of grading equipment.
- D. Protect adjacent paving, soil, trees, shrubs and understory plants to remain from damage during all tree removal operations, and from construction operations. Protection shall include the root system, trunk, limbs, and crown from breakage or scarring, and the soil from compaction.
- E. Remove stumps and immediate root plate. Grind trunk bases and large buttress roots to a depth of the largest buttress root or at least 18 inches below the top most roots, whichever is less, and over the area of three times the diameter of the trunk (DBH).
 - 1. For trees where the stump will fall under new paved areas, grind roots to a total depth of 18 inches below the existing grade. If the sides of the stump hole still have greater than approximately 20% wood visible, continue grinding operation deeper and or wider until the resulting hole has less than 20% wood. Remove all wood chips produced by the grinding operation and back fill in 8 inch layers with controlled fill of a quality acceptable to the site engineer for fill material under structures, compacted to 95% of the maximum dry density standard proctor. The Owner's Representative shall approve each hole at the end of the grinding operation.
 - 2. In areas where the tree location is to be a planting bed or lawn, remove all woodchips and backfill stump holes with planting soil, in maximum of 12 inch layers and compact to 80 - 85% of the maximum dry density standard proctor.

3.08 WATERING

- A. The Contractor is fully responsible to ensure that adequate water is provided to all plants to be preserved during the entire construction period. Adequate water is defined to be maintaining soil moisture above the permanent wilt point to a depth of 8 inches or greater.
- B. The Contractor shall adjust the automatic irrigation system, if available, and apply additional water, using hoses, water tanks or other means as required.
- C. Periodically test moisture content in the soil within the root zone to determine the water content.

3.09 WEED REMOVAL

- A. During the construction period, control any plants that seed in and around the fenced Tree and Plant Protection area at least three times a year.
- B. At the end of construction period, provide final weeding of the Tree and Plant Protection Areas.

3.10 INSECT AND DISEASE CONTROL

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- A. Monitor all plants to remain under contract for disease and insect infestations during the entire construction period. Provide all disease and insect control required to keep the plants in a healthy state using the principles of Integrated Plant Management (IPM). All pesticides shall be applied by a certified pesticide applicator.

3.11 SITE CONDITIONS

- A. Soil aeration: Where directed by Landscape Architect, aerate surface soil compacted during construction. Aerate six (6) feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch diameter holes a minimum of 12 inches deep at 12 inches on center. Backfill holes with and equal mix of augered soil and sand.
- B. Excess mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 3-inch uniform thickness to remain.

3.12 CLEAN-UP AND DISPOSAL OF WASTE MATERIALS

- A. During tree and plant protection work, keep the site free of trash, pavements clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.
1. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.
- B. Once tree protection work is complete, wash all soil from pavements and other structures. Ensure that Mulch is confined to planting beds.
- C. Make all repairs to grades, ruts, and damage to the work or other work at the site.
- D. Burning is not permitted.
- E. Disposal: Remove tree protection fencing and other materials installed for tree and root protection. Remove and recycle all packaging, surplus and excess material, excavated material and displaced trees and plants from the property.
1. Excess mulch may remain on site. Neatly pile excess mulch in an area designated by Landscape Architect or Owner's Representative.

END OF SECTION

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SECTION 01 64 00 - OWNER-FURNISHED PRODUCTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions; and
- C. Materials and Equipment.

1.02 SECTION INCLUDES

- A. Requirements for the following:
 - (1) Installing Owner-furnished materials and equipment.
 - (2) Providing necessary utilities, connections and rough-ins.

1.03 DEFINITIONS

- A. Owner: District, who is providing/furnishing materials and equipment.
- B. Installing Contractor: Contractor, who is installing the materials and equipment furnished by the Owner.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Receive, store and handle products in accordance with the manufacturer's instructions.
- B. Protect equipment items as required to prevent damage during storage and construction.

PART 2 – PRODUCTS

2.01 GENERAL PRODUCT REQUIREMENTS

- A. Installing Contractor's Responsibilities:
 - (1) Verify mounting and utility requirements for Owner-furnished materials and equipment items.

Provide mounting and utility rough in for all items where required.

- (a) Rough in locations, sizes, capacities, and similar type items shall be as indicated and required by product manufacturer.
- B. Owner and Installing Contractor(s) Responsibilities:
 - (1) Owner-Furnished/Contractor Installed ("OFICI"): Furnished by the Owner; installed by the Installing Contractor.

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- (a) General: Owner and Installing Contractor(s) will coordinate deliveries of materials and equipment to coincide with the construction schedule.
- (b) The Owner furnishing specified materials and equipment is responsible to provide manufacturer guarantees as required by the Contract to the Installing Contractor.
- (c) The Installing Contractor shall:
 - 1) Review, verify and accept the approved manufacturer's submittal/Shop Drawings for all materials and equipment required to be installed by the Installing Contractor and furnished by the Owner. Any discrepancies, including but not limited to possible space conflicts, should be brought to the attention of the Project Manager and/or Program Manager, if applicable.
 - 2) Coordinate timely delivery. Installing Contractor shall receive materials and equipment at Site when delivered and give written receipt at time of delivery, noting visible defects or omissions; if such declaration is not given, the Installing Contractor shall assume responsibility for such defects and omissions.
 - 3) Store materials and equipment until ready for installation and protect from loss and damage. Installing Contractor is responsible for providing adequate storage space.
 - 4) Coordinate with other bid package contractors and field measurement to ensure complete installation.
 - 5) Uncrate, assemble, and set in place.
 - 6) Provide adequate supports.
 - 7) Install materials and equipment in accordance with manufacturer's recommendations, instructions, and Shop Drawings, supply labor and material required, and make mechanical, plumbing, and electrical connections required to operate equipment.
 - 8) Be certified by equipment manufacturer for installation of the specific equipment supplied by the Owner.
 - 9) Provide anchorage and/or bracing as required for seismic restraint per Title 24, UBC Standard 27-11 and all other applicable codes.
 - 10) Provide the contract-required warranty and guarantee for all work, materials and equipment, and installation upon its completion and acceptance by the District. Guarantee includes all costs associated with the removal, shipping to and from the Site, and re-installation of any equipment found to be defective.

C. Compatibility with Space and Service Requirements:

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(1) Equipment items shall be compatible with space limitations indicated and as shown on the Contract Documents and specified in other sections of the Specifications.

(2) Modifications to equipment items required to conform to space limitations specified for rough in shall not cause additional cost to the District.

D. Manufacturer's printed descriptions, specifications, and instructions shall govern the Work unless specifically indicated or specified otherwise.

2.02 FURNISHED MATERIALS AND EQUIPMENT

A. All furnished materials and equipment are indicated or scheduled on the Contract Documents.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install equipment items in accordance with the manufacturer's instructions.

B. Set equipment items securely in place, rigidly or flexibly mounted in accordance with manufacturers' directions.

C. Make electrical and mechanical connections as indicated and required.

D. Touch-up and restore damaged or defaced finishes to the Owner's satisfaction.

3.02 CLEANING AND PROTECTION

A. Repair or replace items not acceptable to the Architect or Owner.

B. Upon completion of installation, clean equipment items in accordance with manufacturer's recommendations, and protect from damage until final acceptance of the Work by the Owner.

END OF SECTION

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SECTION 01 66 00 - PRODUCT DELIVERY, STORAGE AND HANDLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Site Access, Conditions and Requirements;
- B. Special Conditions.

1.02 PRODUCTS

- A. Products are as defined in the General Conditions.
- B. Contractor shall not use and/or reuse materials and/or equipment removed from existing Premises, except as specifically permitted by the Contract Documents.
- C. Contractor shall provide interchangeable components of the same manufacturer, for similar components.

1.03 TRANSPORTATION AND HANDLING

- A. Contractor shall transport and handle Products in accordance with manufacturer's instructions.
- B. Contractor shall promptly inspect shipments to confirm that Products comply with requirements, quantities are correct, and products are undamaged.
- C. Contractor shall provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.04 STORAGE AND PROTECTION

- A. Contractor shall store and protect Products in accordance with manufacturer's instructions, with seals and labels intact and legible. Contractor shall store sensitive products in weather-tight, climate controlled enclosures.
- B. For exterior storage of fabricated Products, Contractor shall place on sloped supports, above ground.
- C. Contractor shall provide off-site storage and protection when Site does not permit on-site storage or protection.
- D. Contractor shall cover products subject to deterioration with impervious sheet covering and provide ventilation to avoid condensation.
- E. Contractor shall store loose granular materials on solid flat surfaces in a well-drained area and prevent mixing with foreign matter.

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- F. Contractor shall provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- G. Contractor shall arrange storage of Products to permit access for inspection and periodically inspect to assure Products are undamaged and are maintained under specified conditions.

PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

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SECTION 01 71 23 - FIELD ENGINEERING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Site Investigation, and Soils Investigation Report;
- B. Special Conditions;
- C. Site-Visit Certification.

1.02 REQUIREMENTS INCLUDED:

- A. Contractor shall provide and pay for field engineering services by a California-registered engineer, required for the project, including, without limitations:
 - (1) Survey work required in execution of the Project. Survey work can be performed by a licensed Surveyor or registered Civil Engineer.
 - (2) Civil or other professional engineering services specified, or required to execute Contractor's construction methods.
- B. Contractor is responsible for all staking of improvements.

1.03 QUALIFICATIONS OF SURVEYOR OR ENGINEERS:

Contractor shall only use a qualified licensed engineer or registered land surveyor, to whom District makes no objection.

1.04 SURVEY REFERENCE POINTS:

- A. Existing basic horizontal and vertical control points shall be established by the Surveyor based on consultant's digital drawings.
- B. Contractor shall locate and protect control points prior to starting Site Work and preserve all permanent reference points during construction. In addition Contractor shall:
 - (1) Make no changes or relocation without prior written notice to District and Architect.
 - (2) Report to District and Architect when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
 - (3) Require surveyor to replace Project control points based on original survey control that may be lost or destroyed.

1.05 RECORDS:

Contractor shall maintain a complete, accurate log of all control and survey work as it progresses.

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1.06 SUBMITTALS:

- A. Contractor shall submit name and address of Surveyor and Professional Engineer to District and Architect prior to its/their work on the Project.
- B. On request of District and Architect, Contractor shall submit documentation to verify accuracy of field engineering work, at no additional cost to the District.
- C. Contractor shall submit a certificate signed by registered engineer or surveyor certifying that elevations and locations of improvements are in conformance or nonconformance with Contract Documents.

PART 2 – PRODUCTS Not Used.

PART 3 - EXECUTION

3.01 COMPLIANCE WITH LAWS:

Contractor is responsible for meeting all applicable codes, OSHA, safety and shoring requirements.

3.02 NONCONFORMING WORK:

Contractor is responsible for any re-surveying required by correction of nonconforming work.

END OF SECTION

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SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Inspector, Inspections, and Tests, Integration of Work, Nonconforming Work, and Correction of Work, and Uncovering Work;
- B. Special Conditions;
- C. Hazardous Materials Procedures and Requirements;
- D. Hazardous Materials Certification;
- E. Lead-Based Paint Certification;
- F. Imported Materials Certification.

1.02 CUTTING AND PATCHING:

- A. Contractor shall be responsible for all cutting, fitting, and patching, including associated excavation and backfill, required to complete the Work or to:
 - (1) Make several parts fit together properly.
 - (2) Uncover portions of Work to provide for installation of ill-timed Work.
 - (3) Remove and replace defective Work.
 - (4) Remove and replace Work not conforming to requirements of Contract Documents.
 - (5) Remove Samples of installed Work as specified for testing.
 - (6) Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.
 - (7) Attaching new materials to existing remodeling areas – including painting (or other finishes) to match existing conditions.
- B. In addition to Contract requirements, upon written instructions from the District, Contractor shall uncover Work to provide for observations of covered Work in accordance with the Contract Documents; remove samples of installed materials for testing as directed by District; and remove Work to provide for alteration of existing Work.
- C. Contractor shall not cut or alter Work, or any part of it, in such a way that endangers or compromises the integrity of the Work, the Project, or work of others.

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1.03 SUBMITTALS:

- A. Prior to any cutting or alterations that may affect the structural safety of Project, or work of others, and well in advance of executing such cutting or alterations, Contractor shall submit written notice to District pursuant to the applicable notice provisions of the Contract Documents, requesting consent to proceed with the cutting or alteration, including the following:
 - (1) The work of the District or other trades.
 - (2) Structural value or integrity of any element of Project.
 - (3) Integrity or effectiveness of weather-exposed or weather-resistant elements or systems.
 - (4) Efficiency, operational life, maintenance or safety of operational elements.
 - (5) Visual qualities of sight-exposed elements.
- B. Contractor's Request shall also include:
 - (1) Identification of Project.
 - (2) Description of affected Work.
 - (3) Necessity for cutting, alteration, or excavations.
 - (4) Affects of Work on District, other trades, or structural or weatherproof integrity of Project.
 - (5) Description of proposed Work:
 - (a) Scope of cutting, patching, alteration, or excavation.
 - (b) Trades that will execute Work.
 - (c) Products proposed to be used.
 - (d) Extent of refinishing to be done.
 - (6) Alternates to cutting and patching.
 - (7) Cost proposal, when applicable.
 - (8) The scheduled date the Contractor intends to perform the Work and the duration of time to complete the Work.
 - (9) Written permission of District or other District contractor(s) whose work will be affected.

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1.04 QUALITY ASSURANCE:

- A. Contractor shall ensure that cutting, fitting, and patching shall achieve security, strength, weather protection, appearance for aesthetic match, efficiency, operational life, maintenance, safety of operational elements, and the continuity of existing fire ratings.
- B. Contractor shall ensure that cutting, fitting, and patching shall successfully duplicate undisturbed adjacent profiles, materials, textures, finishes, colors, and that materials shall match existing construction. Where there is dispute as to whether duplication is successful or has been achieved to a reasonable degree, the District's decision shall be final.

1.05 PAYMENT FOR COSTS:

- A. Cost caused by ill-timed or defective Work or Work not conforming to Contract Documents, including costs for additional services of the District, its consultants, including but not limited to the Construction Manager, the Architect, the Project Inspector(s), Engineers, and Agents, will be paid by Contractor and/or deducted from the Contract by the District.
- B. District shall only pay for cost of Work if it is part of the original Contract Price or if a change has been made to the contract in compliance with the provisions of the General Conditions. Cost of Work performed upon instructions from the District, other than defective or nonconforming Work, will be paid by District on approval of written Change Order. Contractor shall provide written cost proposals prior to proceeding with cutting and patching.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Contractor shall provide for replacement and restoration of Work removed. Contractor shall comply with the Contract Documents and with the Industry Standard(s), for the type of Work, and the Specification requirements for each specific product involved. If not specified, Contractor shall first recommend a product of a manufacturer or appropriate trade association for approval by the District.
- B. Materials to be cut and patched include those damaged by the performance of the Work.

PART 3 – EXECUTION

3.01 INSPECTION:

- A. Contractor shall inspect existing conditions of the Site and the Work, including elements subject to movement or damage during cutting and patching, excavating and backfilling. After uncovering Work, Contractor shall inspect conditions affecting installation of new products.
- B. Contractor shall report unsatisfactory or questionable conditions in writing to District as indicated in the General Conditions and shall proceed with Work as indicated in the General Conditions by District.

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3.02 PREPARATION:

- A. Contractor shall provide shoring, bracing and supports as required to maintain structural integrity for all portions of the Project, including all requirements of the Project.
- B. Contractor shall provide devices and methods to protect other portions of Project from damage.
- C. Contractor shall, provide all necessary protection from weather and extremes of temperature and humidity for the Project, including without limitation, any work that may be exposed by cutting and patching Work. Contractor shall keep excavations free from water.

3.03 ERECTION, INSTALLATION AND APPLICATION:

- A. With respect to performance, Contractor shall:
 - (1) Execute fitting and adjustment of products to provide finished installation to comply with and match specified tolerances and finishes.
 - (2) Execute cutting and demolition by methods that will prevent damage to other Work, and provide proper surfaces to receive installation of repairs and new Work.
 - (3) Execute cutting, demolition excavating, and backfilling by methods that will prevent damage to other Work and damage from settlement.
- B. Contractor shall employ original installer or fabricator to perform cutting and patching for:
 - (1) Weather-exposed surfaces and moisture-resistant elements such as roofing, sheet metal, sealants, waterproofing, and other trades.
 - (2) Sight-exposed finished surfaces.
- C. Contractor shall execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes as shown or specified in the Contract Documents including, without limitation, the Drawings and Specifications.
- D. Contractor shall fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. Contractor shall conform to all Code requirements for penetrations or the Drawings and Specifications, whichever calls for a higher quality or more thorough requirement. Contractor shall maintain integrity of both rated and non-rated fire walls, ceilings, floors, etc.
- E. Contractor shall restore Work which has been cut or removed. Contractor shall install new products to provide completed Work in accordance with requirements of the Contract Documents and as required to match surrounding areas and surfaces.
- F. Contractor shall refinish all continuous surfaces to nearest intersection as necessary to match the existing finish to any new finish.

END OF SECTION

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SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- B. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- C. Comply with construction waste reduction, disposal and recycling requirements of the California Code of Regulations, Title 24, Part 11, the California Green Building Standards Code, CALGreen.
- D. Comply with more restrictive construction waste reduction, disposal and recycling requirements of the local Authority Having Jurisdiction (AHJ) where applicable.
- E. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
 1. Aluminum and plastic beverage containers.
 2. Corrugated cardboard.
 3. Wood pallets.
 4. Clean dimensional wood.
 5. Land clearing debris, including brush, branches, logs, and stumps.
 6. Concrete: May be crushed and used as riprap, aggregate, sub-base material, or fill.
 7. Bricks: May be used on project if whole, or crushed and used as landscape cover, sub-base material, or fill.
 8. Concrete masonry units: May be used on project if whole, or crushed and used as sub-base material or fill.
 9. Precast concrete panels: May be used for erosion control or landscape features.
 10. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 11. Glass.

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12. Gypsum drywall and plaster.
 13. Plastic buckets.
 14. Asphalt roofing shingles.
 15. Paint.
 16. Plastic sheeting.
 17. Rigid foam insulation.
 18. Vinyl siding.
 19. Windows, doors, and door hardware.
 20. Plumbing fixtures.
 21. Mechanical and electrical equipment including light fixtures and lamps.
 22. Acoustical ceiling tile and panels.
- F. Universal Waste as defined by The State of California Department of Toxic Substances Control (DTSC) may not be disposed of in landfills or by incineration.
- G. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
- H. Methods of trash/waste disposal that are not acceptable are:
1. Burning on the project site.
 2. Burying on the project site.
 3. Dumping or burying on other property, public or private.
 4. Other illegal dumping or burying.
 5. Incineration, either on- or off-site.
- I. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

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1.02 RELATED REQUIREMENTS

- A. A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 11 00 - Summary of Work: List of items to be salvaged from the existing building for relocation in project or for District.
- C. Division 31: Handling and disposal of land clearing debris.

1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

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- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Universal Waste: Batteries, electronic waste, and mercury-containing components as defined by the State of California Department of Toxic Substances Control (DTSC).
- Q. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

A. CALGreen Submittals:

1. Construction Waste Management (CWM) Plan for CALGreen 5.508.1 – Plan to recycle and/or salvage for reuse a minimum of 65% of the non-hazardous construction and demolition waste in accordance with CALGreen 5.508.1.1, CALGreen 5.508.1.2 or CALGreen 5.508.1.3; or meet a local construction and demolition waste management ordinance, whichever is more stringent.
2. Document compliance utilizing Compliance Forms provided by the State of California:
 - a. Construction Waste Management Plan
 - b. Construction Waste Management Worksheet
 - c. Construction Waste Management Acknowledgement
3. California prohibited Universal Waste materials shall be diverted from landfills. Comply with the hazardous waste regulations (California. Code of Regulations, Title. 22, for the handling, transport and recycling in accordance with the universal waste regulations (UWR).
 - a. Universal wastes include:
 - 1) Electronic devices: Includes any electronic device that is a hazardous waste (with or without a Cathode Ray Tube (CRT)), including televisions, computer monitors, cell phones, VCR's, computer CPU's and portable DVD players.
 - 2) Batteries: Most household-type batteries, including rechargeable nickel-cadmium batteries, silver button batteries, mercury batteries, alkaline batteries and other batteries that exhibit a characteristic of a hazardous waste

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- 3) Electric lamps: Fluorescent tubes and bulbs, high intensity discharge lamps, sodium vapor lamps and electric lamps that contain added mercury, as well as any other lamp that exhibits a characteristic of a hazardous waste. (e.g., lead).
 - 4) Mercury-containing equipment: Thermostats, mercury switches, mercury thermometers, pressure or vacuum gauges, dilators and weighted tubing, mercury rubber flooring, mercury gas flow regulators, dental amalgams, counterweights, dampers and mercury added novelties such as jewelry, ornaments and footwear.
 - 5) CRTs: The glass picture tubes removed from devices such as televisions and computer monitors.
 - 6) CRT glass: A cathode ray tube that has been accidentally broken or processed for recycling.
 - 7) Non-empty aerosol cans
4. Excavated soil and land clearing debris:
- a. 100% of trees, stumps, rocks, and associated vegetation and soils resulting from land clearing shall be reused or recycled.
- B. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 2. Submit Report on a form acceptable to District.
 3. Landfill Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 4. Recycled and Salvaged Materials: Include the following information for each:

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- a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
5. Material Reused on Project: Include the following information for each:
- a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards.
 - c. Include weight tickets as evidence of quantity.
6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 10 00 for list of items to be salvaged from the existing building for relocation in project or for District.
- B. See Division 01 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, District, and Architect.

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- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
1. Prebid meeting.
 2. Preconstruction meeting.
 3. Regular job-site meetings.
 4. Job safety meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
1. As a minimum, provide:
 - a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
 - b. Separate dumpsters for each category of recyclable.
 - c. Recycling bins at worker lunch area.
 2. Provide containers as required.
 3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
 4. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
 5. Locate enclosures out of the way of construction traffic.
 6. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 7. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
 8. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

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- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

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SECTION 01 76 00 - ALTERATION PROJECT PROCEDURES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Integration of Work, Purchase of Materials and Equipment, Uncovering of Work and Non-conforming Work and Correction of Work and Trenches;
- B. Special Conditions.

PART 2 - PRODUCTS

2.01 PRODUCTS FOR PATCHING AND EXTENDING WORK:

- A. New Materials: As specified in the Contract Documents including, without limitation, in the Specifications, Contractor shall match existing products, conditions, and work for patching and extending work.
- B. Type and Quality of Existing Products: Contractor shall determine by inspection, by testing products where necessary, by referring to existing conditions and to the Work as a standard.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Contractor shall verify that demolition is complete and that areas are ready for installation of new Work.
- B. By beginning restoration Work, Contractor acknowledges and accepts the existing conditions.

3.02 PREPARATION:

- A. Contractor shall cut, move, or remove items as necessary for access to alterations and renovation Work. Contractor shall replace and restore these at completion.
- B. Contractor shall remove unsuitable material not as salvage unless otherwise indicated in the Contract Documents. Unsuitable material may include, without limitation, rotted wood, corroded metals, and deteriorated masonry and concrete. Contractor shall replace materials as specified for finished Work.
- C. Contractor shall remove debris and abandoned items from all areas of the Site and from concealed spaces.
- D. Contractor shall prepare surface and remove surface finishes to provide for proper installation of new Work and finishes.

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- E. Contractor shall close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity. Contractor shall insulate ductwork and piping to prevent condensation in exposed areas. Contractor shall insulate building cavities for thermal and/or acoustical protection, as detailed.

3.03 INSTALLATION:

- A. Contractor shall coordinate Work of all alternations and renovations to expedite completion and to accommodate District occupancy.
- B. Designated Areas and Finishes: Contractor shall complete all installations in all respects, including operational, mechanical work and electrical work.
- C. Contractor shall remove, cut, and patch Work in a manner to minimize damage and to provide a means of restoring Products and finishes to original or specified condition.
- D. Contractor shall refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat and square or straight transition to adjacent finishes.
- E. Contractor shall install products as specified in the Contract Documents, including without limitation, the Specifications.

3.04 TRANSITIONS:

- A. Where new Work abuts or aligns with existing, Contractor shall perform a smooth and even transition. Patched Work must match existing adjacent work in texture and appearance.
- B. When finished surfaces are cut so that a smooth transition with new Work is not possible, Contractor shall terminate existing surface along a straight line at a natural line of division and make a recommendation for resolution to the District and the Architect for review and approval.

3.05 ADJUSTMENTS:

- A. Where removal of partitions or walls results in adjacent spaces becoming one, Contractor shall rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
- B. Where a change of plane of 1/4 inch or more occurs, Contractor shall submit a recommendation for providing a smooth transition to the District and the Architect for review and approval.
- C. Contractor shall trim and seal existing wood doors and shall trim and paint metal doors as necessary to clear new floor finish and refinish trim as required.
- D. Contractor shall fit Work at penetrations of surfaces.

3.06 REPAIR OF DAMAGED SURFACES:

- A. Contractor shall patch or replace portions of existing surfaces, which are damaged, lifted, discolored, or showing other imperfections, in the area where the Work is performed.

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- B. Contractor shall repair substrate prior to patching finish.

3.07 CULTIVATED AREAS AND OTHER SURFACE IMPROVEMENTS:

- A. Cultivated or planted areas and other surface improvements which are damaged by actions of the Contractor shall be restored by Contractor to their original condition or better, where indicated.
- B. Contractor shall protect and replace, if damaged, all existing guard posts, barricades, and fences.
- C. Contractor shall give special attention to avoid damaging or killing trees, bushes and/or shrubs on the Premises and/or identified in the Contract Documents, including without limitation, the Drawings.

3.08 FINISHES:

- A. Contractor shall finish surfaces as specified in the Contract Documents, including without limitations, the provisions of all Divisions of the Specifications.
- B. Contractor shall finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, Contractor shall refinish entire surface to nearest intersections.

3.09 CLEANING:

- A. Contractor shall continually clean the Site and the Premises as indicated in the Contract Documents, including without limitation, the provisions in the General Conditions and the Specifications regarding cleaning.

END OF SECTION

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SECTION 01 77 00 - CONTRACT CLOSEOUT AND FINAL CLEANING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Completion of Work;
- B. Special Conditions;
- C. Temporary Facilities and Controls.

1.02 CLOSEOUT PROCEDURES

Contractor shall comply with all closeout provisions as indicated in the General Conditions.

1.03 FINAL CLEANING

- A. Contractor shall execute final cleaning prior to final inspection.
- B. Contractor shall clean interior and exterior glass and all surfaces exposed to view; remove temporary labels, tape, stains, and foreign substances, polish transparent and glossy surfaces, wax and polish new vinyl floor surfaces, vacuum carpeted and soft surfaces.
- C. Contractor shall clean equipment and fixtures to a sanitary condition.
- D. Contractor shall replace filters of operating equipment.
- E. Contractor shall clean debris from roofs, gutters, down spouts, and drainage systems.
- F. Contractor shall clean Site, sweep paved areas, and rake clean landscaped surfaces.
- G. Contractor shall remove waste and surplus materials, rubbish, and construction facilities from the Site and surrounding areas.

1.04 ADJUSTING

Contractor shall adjust operating products and equipment to ensure smooth and unhindered operation.

1.05 RECORD DOCUMENTS AND SHOP DRAWINGS

- A. Contractor shall legibly mark each item to record actual construction, including:
 - (1) Measured depths of foundation in relation to finish floor datum.
 - (2) Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permit surface improvements.

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- (3) Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
- (4) Field changes of dimension and detail.
- (5) Details not on original Contract Drawings
- (6) Changes made by modification(s).
- (7) References to related Shop Drawings and modifications.
- B. Contractor will provide one hard copy set and one electronic set of Record Drawings to District.
- C. Contractor shall submit all required documents to District and/or Architect prior to or with its final Application for Payment.

1.06 INSTRUCTION OF DISTRICT PERSONNEL

- A. Before final inspection, at agreed upon times, Contractor shall instruct District's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. For equipment requiring seasonal operation, Contractor shall perform instructions for other seasons within six months or by the change of season.
- C. Contractor shall use operation and maintenance manuals as basis for instruction. Contractor shall review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- D. Contractor shall prepare and insert additional data in Operation and Maintenance Manual when the need for such data becomes apparent during instruction.
- E. Contractor shall review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

1.07 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Contractor shall provide products, spare parts, maintenance, and extra materials in quantities specified in the Specifications and in Manufacturer's recommendations.
- B. Contractor shall provide District with all required Operation and Maintenance Data at one time. Partial or piecemeal submissions of Operation and Maintenance Data will not be accepted.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END OF SECTION

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SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Completion of the Work;
- B. Special Conditions.

1.02 QUALITY ASSURANCE:

Contractor shall prepare instructions and data by personnel experienced in maintenance and operation of described products.

1.03 FORMAT:

- A. Contractor shall prepare data in the form of an instructional manual entitled "OPERATIONS AND MAINTENANCE MANUAL & INSTRUCTIONS" ("Manual").
- B. Manuals and Instructions to be submitted in both PDF and hard copy formats.
- C. Binders: Contractor shall use commercial quality, 8-1/2 by 11 inch, three-side rings, with durable plastic covers; two inch maximum ring size. When multiple binders are used, Contractor shall correlate data into related consistent groupings.
- D. Cover: Contractor shall identify each binder with typed or printed title "OPERATION AND MAINTENANCE MANUAL & INSTRUCTIONS"; and shall list title of Project and identify subject matter of contents.
- E. Contractor shall arrange content by systems process flow under section numbers and sequence of Table of Contents of the Contract Documents.
- F. Contractor shall provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- G. Text: The content shall include Manufacturer's printed data, or typewritten data on 24 pound paper.
- H. Drawings: Contractor shall provide with reinforced punched binder tab and shall bind in with text; folding larger drawings to size of text pages.
- I. Contractor will also submit the "OPERATIONS AND MAINTENANCE MANUAL & INSTRUCTIONS" (Manual) electronically (in PDF format) at the completion of the Project.

1.04 CONTENTS, EACH VOLUME:

- A. Table of Contents: Contractor shall provide title of Project; names, addresses, and telephone numbers of the Architect, any engineers, subconsultants, Subcontractor(s), and Contractor with name of responsible parties; and schedule of products and systems, indexed to content of the volume.

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- B. For Each Product or System: Contractor shall list names, addresses, and telephone numbers of Subcontractor(s) and suppliers, including local source of supplies and replacement parts.
- C. Product Data: Contractor shall mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- D. Drawings: Contractor shall supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Contractor shall not use Project Record Documents as maintenance drawings.
- E. Text: The Contractor shall include any and all information as required to supplement product data. Contractor shall provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- F. Warranties and Bonds: Contractor shall bind in one copy of each.

1.05 MANUAL FOR MATERIALS AND FINISHES:

- A. Building Products, Applied Materials, and Finishes: Contractor shall include product data, with catalog number, size, composition, and color and texture designations. Contractor shall provide information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Contractor shall include Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture Protection and Weather Exposed Products: Contractor shall include product data listing applicable reference standards, chemical composition, and details of installation. Contractor shall provide recommendations for inspections, maintenance, and repair.
- D. Additional Requirements: Contractor shall include all additional requirements as specified in the Specifications.
- E. Contractor shall provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.06 MANUAL FOR EQUIPMENT AND SYSTEMS:

- A. Each Item of Equipment and Each System: Contractor shall include description of unit or system, and component parts and identify function, normal operating characteristics, and limiting conditions. Contractor shall include performance curves, with engineering data and tests, and complete nomenclature, and commercial number of replaceable parts.
- B. Panelboard Circuit Directories: Contractor shall provide electrical service characteristics, controls, and communications.
- C. Contractor shall include color coded wiring diagrams as installed.
- D. Operating Procedures: Contractor shall include start-up, break-in, and routine normal operating instructions and sequences. Contractor shall include regulation, control, stopping, shut-down, and emergency instructions. Contractor shall include summer, winter, and any special operating instructions.

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- E. Maintenance Requirements: Contractor shall include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- F. Contractor shall provide servicing and lubrication schedule, and list of lubricants required.
- G. Contractor shall include manufacturer's printed operation and maintenance instructions.
- H. Contractor shall include sequence of operation by controls manufacturer.
- I. Contractor shall provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Contractor shall provide control diagrams by controls manufacturer as installed.
- K. Contractor shall provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- L. Contractor shall provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- M. Contractor shall provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- N. Additional Requirements: Contractor shall include all additional requirements as specified in Specification(s).
- O. Contractor shall provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.07 SUBMITTAL:

- A. Contractor shall submit to the District for review two (2) copies of preliminary draft or proposed formats and outlines of the contents of the Manual within thirty (30) days of Contractor's start of Work.
- B. For equipment, or component parts of equipment put into service during construction and to be operated by District, Contractor shall submit draft content for that portion of the Manual within ten (10) days after acceptance of that equipment or component.
- C. Contractor shall submit two (2) copies of a complete Manual in final form prior to final Application for Payment. Copy will be returned with Architect/Engineer comments. Contractor must revise the content of the Manual as required by District prior to District's approval of Contractor's final Application for Payment.
- D. Contractor must submit two (2) copies of revised Manual in final form within ten (10) days after final inspection.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END OF SECTION

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SECTION 01 78 36 - WARRANTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Warranty/Guarantee Information;
- B. Special Conditions.

1.02 FORMAT

- A. Binders: Contractor shall use commercial quality, 8-1/2 by 11 inch, three-side rings, with durable plastic covers; two inch maximum ring size.
- B. Cover: Contractor shall identify each binder with typed or printed title "WARRANTIES" and shall list title of Project.
- C. Table of Contents: Contractor shall provide title of Project; name, address, and telephone number of Contractor and equipment supplier; and name of responsible principal. Contractor shall identify each item with the number and title of the specific Specification, document, provision, or section in which the name of the product or work item is specified.
- D. Contractor shall separate each warranty with index tab sheets keyed to the Table of Contents listing, providing full information and using separate typed sheets as necessary. Contractor shall list each applicable and/or responsible Subcontractor(s), supplier(s), and/or manufacturer(s), with name, address, and telephone number of each responsible principal(s).
- E. Contractor will also submit all Warranties electronically (in PDF format) at the completion of the Project.

1.03 PREPARATION:

- A. Contractor shall obtain warranties, executed in duplicate by each applicable and/or responsible subcontractor(s), supplier(s), and manufacturer(s), within ten (10) days after completion of the applicable item or work. Except for items put into use with District's permission, Contractor shall leave date of beginning of time of warranty blank until the date of completion is determined.
- B. Contractor shall verify that documents are in proper form, contain full information, and are notarized, when required.
- C. Contractor shall co-execute submittals when required.
- D. Contractor shall retain warranties until time specified for submittal.

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1.04 TIME OF SUBMITTALS:

- A. For equipment or component parts of equipment put into service during construction with District's permission, Contractor shall submit a draft warranty for that equipment or component within ten (10) days after acceptance of that equipment or component.
- B. Contractor shall submit for District approval all warranties and related documents within ten (10) days after date of completion. Contractor must revise the warranties as required by the District prior to District's approval of Contractor's final Application for Payment.
- C. For items of work delayed beyond date of completion, Contractor shall provide an updated submittal within ten (10) days after acceptance, listing the date of acceptance as start of warranty period.

PART 2 - PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END OF SECTION

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SECTION 01 78 39 - RECORD DOCUMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions including, without limitation, Documents on Work;
- B. Special Conditions.
- C. Summary of Work.

PART 2 - RECORD DRAWINGS

2.01 GENERAL:

- A. Contractor shall maintain on Site one set of the following record documents; Contractor shall record actual revisions to the Work:
 - (1) Contract Drawings.
 - (2) Specifications.
 - (3) Addenda.
 - (4) Change Orders and other modifications to the Contract.
 - (5) Reviewed shop drawings, product data, and samples.
 - (6) Field test records.
 - (7) Inspection certificates.
 - (8) Manufacturer's certificates.
- B. As indicated in the Contract Documents, the District will provide Contractor with one set of reproducible, full size Contract Drawings electronically.
- C. Contractor shall maintain at each Project Site one set of marked-up plans and shall transfer all changes and information to those marked-up plans, as often as required to keep information concurrent with construction progress, but in no case less than once each month. Contractor shall submit to the Project Inspector one set of reproducible vellums of the Project Record Drawings ("As-Builts") showing all changes incorporated into the Work since the preceding monthly submittal. The As-Builts shall be available at the Project Site. The Contractor shall submit reproducible vellums at the conclusion of the Project following review of the blue-line prints.
- D. Label and date each Record Drawing "RECORD DOCUMENT" in legibly printed letters.

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- E. All deviations in construction including, but not limited to, pipe and conduit locations and deviations caused by without limitation Change Orders, Construction Claim Directives, RFIs, and Addenda, shall be accurately and legibly recorded by Contractor.
- F. Locations and changes shall be done by Contractor in a neat and legible manner and, where applicable, indicated by drawing a "cloud" around the changed or additional information.
- G. Contractor shall store Record Documents separate from documents used for construction. Provide files, racks, and secure storage for Record Documents and samples.

2.02 RECORD DRAWING INFORMATION:

- A. Contractor shall record the following information:
 - (1) Locations of Work buried under or outside each building, including, without limitation, all utilities, plumbing and electrical lines, and conduits.
 - (2) Actual numbering of each electrical circuit to match panel schedule.
 - (3) Locations of significant Work concealed inside each building whose general locations are changed from those shown on the Contract Drawings.
 - (4) Locations of all items, not necessarily concealed, which vary from the Contract Documents.
 - (5) Installed location of all cathodic protection anodes.
 - (6) Deviations from the sizes, locations, and other features of installations shown in the Contract Documents.
 - (7) Locations of underground work, points of connection with existing utilities, changes in direction, valves, manholes, catch basins, capped stubouts, invert elevations, etc.
 - (8) Sufficient information to locate Work concealed in each building with reasonable ease and accuracy.

In some instances, this information may be recorded by dimension. In other instances, it may be recorded in relation to the spaces in the building near which it was installed.

- B. Contractor shall provide additional drawings as necessary for clarification.
- C. Contractor shall provide reproducible record drawings, made from final Shop Drawings marked "No Exceptions Taken" or "Approved as Noted."
- D. After review and approval of the marked-up specifications by the Project Inspector, Contractor shall provide electronic copies of the drawings (in PDF format) with one file with all of the sheets and one set of individual sheet files at the conclusion of the Project.

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PART 3 - RECORD SPECIFICATIONS

3.01 GENERAL:

- A. Contractor shall mark each section legibly to record:
 - (1) Manufacturer, trade name, model / catalog number, and supplier of each Product and item of equipment actually installed.
 - (2) Product substitutions or alternates utilized.
 - (3) Changes made by Addenda and Change Orders and written directives.
- B. After review and approval of the marked-up specifications by the Project Inspector, Contractor shall provide one electronic copy of the specifications (in PDF format) at the conclusion of the Project.

PART 4 - MAINTENANCE OF RECORD DOCUMENTS

4.01 GENERAL

- A. Contractor shall store Record Documents apart from documents used for construction as follows:
 - (1) Provide files and racks for storage of Record Documents.
 - (2) Maintain Record Documents in a clean, dry, legible condition and in good order.
- B. Contractor shall not use Record Documents for construction purposes.

PART 5 – PRODUCTS – NOT USED

END OF SECTION

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SECTION 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General requirements and procedures for compliance with the following:
 - 1. Forest Stewardship Council (FSC) Certified Wood.
 - 2. California Code of Regulation Title 24 Part 11 California Green Building Standards Code (CALGreen) Non-Residential Mandatory Measures.
 - 3. Construction Waste Management and Disposal including salvaging, recycling, and disposing of demolition and construction waste.
 - 4. Construction indoor air quality management.
 - 5. Buy-Clean-California Act Environmental Product Declarations (EPD's) [State projects and certain local Authorities Having Jurisdiction]

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 74 19 - Construction Waste Management and Disposal.
- C. Section 01 91 13 - General Commissioning Requirements.

1.03 DEFINITIONS

- A. Certificates of Chain-of-Custody: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.
- B. FSC Certified Wood: Wood products that are verified from the forest of origin through the supply chain to ensure that the forest products used are from responsibly harvested and verified sources.
- C. Product Category Rule (PCR): A PCR is a set of rules, requirements and guidelines for a product group.
- D. Environmental Product Declaration (EPD): An Environmental Product Declaration is an independently verified and registered document that communicates information about the

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life cycle environmental impact of products. The raw material producer conducts a product life cycle assessment and works with a program operator to verify and publish an EPD. An EPD needs to follow the guidelines of ISO 14025 (Type III Environmental Declarations – Principles and Procedures) and the applicable Product Category Rule (PCR).

1.04 SUBMITTALS

- A. FSC Certified Wood: Submit product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
- B. CALGreen: Additional CALGreen submittal requirements are included in other sections of the Specifications.
 - 1. CALGreen submittals are in addition to other submittals. If documentation is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to demonstrate compliance with indicated CALGreen requirements.
- C. Buy-Clean-California: Additional Buy-Clean-California submittal requirements are included in other sections of the Specifications.
 - 1. Buy-Clean-California submittals are in addition to other submittals. If documentation is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to demonstrate compliance with indicated Buy-Clean-California requirements.

PART 2 PRODUCTS

2.01 CERTIFIED WOOD

- A. Not less than (50) percent (by cost) of wood-based materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - 1. Wood-based materials include but are not limited to the following materials when made from made wood, engineered wood products, or wood-based panel products:
 - a. Rough carpentry.
 - b. Miscellaneous carpentry.
 - c. Finish carpentry.
 - d. Architectural woodwork.
 - e. Wood flooring.
 - f. Wood cabinets.

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- g. Non-rented temporary construction, including bracing, concrete formwork, pedestrian barriers, and temporary protection.

2.02 LOW-EMITTING MATERIALS

- A. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with the Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products as specified below.
- B. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

TABLE 5.504.4.1	
ADHESIVE VOC LIMIT (Notes 1,2)	
Less Water and Less Exempt Compounds in Grams Per Liter	
ARCHITECTURAL APPLICATIONS	CURRENT VOC LIMIT
Indoor carpet adhesives	50
Carpet pad adhesives	50
Outdoor carpet adhesives	150
Wood flooring adhesive	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT and asphalt tile adhesives	50
Drywall panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Single-ply roof membrane adhesives	250
Other adhesive not specifically listed	50
SPECIALTY APPLICATIONS	
PVC welding	510
CPVC welding	490
ABS welding	325

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Plastic cement welding	250
Adhesive primer for plastic	550
Contact adhesive	80
Special purpose contact adhesive	250
Structural wood member adhesive	140
Top and trim adhesive	250
SUBSTRATE SPECIFIC APPLICATION	
Metal to metal	30
Plastic foams	50
Porous material (except wood)	50
Wood	30
Fiberglass	80
Notes	
1. If an adhesive is used to bond dissimilar substrates together the adhesive with the highest VOC content shall be allowed.	
2. For additional information regarding methods to measure the VOC content specified in this table, see South Coast Air Quality Management District Rule 1168, http://www.arb.ca.gov/DRDB/SC/CURHTML/R1168.PDF .	
TABLE 5.504.4.2	
SEALANT VOC LIMIT	
Less Water and Less Exempt Compounds in Grams per Liter	
SEALANTS	CURRENT VOC LIMIT
Architectural	250
Marine deck	760
Nonmembrane roof	300
Roadway	250
Single-ply roof membrane	450
Other	420
Note: For additional information regarding methods to measure the VOC content specified in these tables, see South Coast Air Quality Management District Rule 1168.	

- C. Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control Measure, as shown in Table 5.504.4.3, unless more stringent local limits apply. The VOC content limit for coatings that do not meet the definitions for the specialty coatings categories listed in Table 5.504.4.3, shall be determined by classifying the coating as a Flat, Nonflat, or Nonflat-High Gloss coating, based on its gloss, as defined in Subsections 4.21, 4.36 and 4.37 of the 2007 California Air Resources

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Board, Suggested Control Measure, and the corresponding Flat, Nonflat or Nonflat-High Gloss VOC limit in Table 5.504.4.3 shall apply.

- D. Aerosol paints and coatings. Aerosol paints and coatings shall meet the PWMIR Limits for ROC in Section 94522(a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, in Sections 94522(c)(2) and (d)(2) of California Code of Regulations, Title 17, commencing with Section 94520; and in areas under the jurisdiction of the Bay Area Air Quality Management District additionally comply with the percent VOC by weight of product limits of Regulation 8 Rule 49.

TABLE 5.504.4.3	
VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS (Notes 2, 3)	
Grams of VOC per Liter of Coating, Less Water and Less Exempt Compounds	
COATING CATEGORY	CURRENT LIMIT
Flat coatings	50
Nonflat coatings	100
SPECIALTY COATINGS	
Aluminum roof coatings	400
Basement specialty coatings	400
Bituminous roof coatings	50
Bituminous roof primers	350
Bond breakers	350
Concrete curing compounds	350
Concrete/masonry sealers	100
Driveway sealers	50
Dry fog coatings	150
Faux finishing coatings	350
Fire resistive coatings	350
Floor coatings	100
Form-release compounds	250
Graphic arts coatings (sign paints)	500
High temperature coatings	420
Industrial maintenance coatings	250
Low solids coatings (Note 1)	120
Magnesite cement coatings	450
Mastic texture coatings	100
Metallic pigmented coatings	500
Multicolor coatings	250
Pretreatment wash primers	420

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Primers, sealers, and undercoaters	100
Reactive penetrating sealers	350
Recycled coatings	250
Roof coatings	50
Rust preventative coatings	250
Shellacs Clear	730
Shellacs Opaque	550
Specialty primers, sealers and undercoaters	100
Stains	250
Stone consolidants	450
Swimming pool coatings	340
Traffic marking coatings	100
Tub and tile refinish coatings	420
Waterproofing membranes	250
Wood coatings	275
Wood preservatives	359
Zinc-rich primers	340
Notes	
1. Grams of VOC per liter of coating, including water and including exempt compounds	
2. The specified limits remain in effect unless revised limits are listed in subsequent columns in the table.	
3. Values in this table are derived from those specified by the California Air Resources Board, Architectural Coatings Suggested Control Measure, February 1, 2008. More information is available from the Air Resources Board.	

- E. Carpet systems. All carpet installed in the building interior shall meet at least one of the following testing and product requirements:
1. Carpet and Rug Institute's Green Label Plus Program.
 2. Compliant with the VOC-emission limits and testing requirements specified in the California Department of Public Health Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, February 2010 (also known as CDPH Standard Method V1.1 or Specification 01350).
 3. NSF/ANSI 140 at the Gold level or higher.
 4. Scientific Certifications Systems Sustainable Choice.

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5. Compliant with the Collaborative for High Performance Schools California (CA-CHPS) Criteria Interpretation for EQ 7.0 and EQ 7.1 (formerly EQ 2.2) dated July 2012 and listed in the CHPS High Performance Product Database.
- F. Carpet cushion. All carpet cushion installed in the building interior shall meet the requirements of the Carpet and Rug Institute's Green Label program.
- G. Carpet adhesive. All carpet adhesive shall meet the requirements of Table 5.504.4.1.
- H. Resilient flooring systems. For 80 percent of floor area receiving resilient flooring, installed resilient flooring shall meet at least one of the following :
 1. Certified under the Resilient Floor Covering Institute (RFCI) FloorScore program;
 2. Compliant with the VOC-emission limits and testing requirements specified in the California Department of Public Health's 2010 Standard Method for the Testing and Evaluation Chambers, Version 1.1, February 2010;
 3. Compliant with the Collaborative for High Performance Schools California (CA-CHPS) Criteria Interpretation for EQ 7.0 and EQ 7.1 (formerly EQ 2.2) dated July 2012 and listed in the CHPS High Performance Product Database; or
 4. Products certified under the UL GREENGUARD Gold (formerly the Greenguard Children & Schools program).
- I. Composite wood products. Hardwood plywood, particleboard, and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in ARB's Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.). Those materials not exempted by the ATCM must meet the specified emission limits as shown in Table 5.504.4.5.

TABLE 5.504.4.5	
FORMALDEHYDE LIMITS (Note 1)	
Maximum Formaldehyde Emissions in Parts per Million	
PRODUCT	CURRENT LIMIT
Hardwood plywood veneer core	
Hardwood plywood composite core	
Particleboard	
Medium density fiberboard	
Thin medium density fiberboard (Note 2)	
Notes	
1. Values in this table are derived from those specified by the California Air Resources Board, Air Toxics Control Measure for Composite Wood as tested in ac-	

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cordance with ASTM E1333. For additional information, see California Code of Regulations, Title 17, Sections 93120 through 93120.12.	
2. Thin medium density fiberboard has a maximum thickness of 5/16 inch (8 mm).	

2.03 BUY-CLEAN-CALIFORNIA ACT REQUIREMENTS

- A. Comply with California Public Contract Code 3500-3505. Submit Environmental Product Declarations documenting that the Global Warming Potential (GWP) for the following materials does not exceed the limits established by the State of California Department of General Services (DGS):
 1. Concrete Reinforcing Steel: Carbon steel reinforcing bar.
 2. Structural Steel.
 3. Mineral wool board insulation.
 4. Flat glass.
- B. Informational resources:
 1. <https://programoperators.org>
 2. <https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/Buy-Clean-California-Act>
- C. Structural steel and carbon steel rebar
 1. Title: North American Product Category Rule for Designated Steel Construction Products
 2. Valid through: May 5, 2020
 3. Version: 1.0
 4. Program operator: SCS Global Services
- D. Flat glass
 1. Title: GANA PCR for Flat Glass: UN CPC 3711
 2. Valid through: March 31, 2020 (extended per PCRExt 2019-101)
 3. Program operator: NSF International

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E. Mineral wool board insulation

1. Title: Part B: Building Envelope Thermal Insulation EPD requirements
2. Valid through: April 10, 2023
3. Version: 2.0
4. Program operator: UL Environment

PART 3 EXECUTION

3.01 CONSTRUCTION WASTE MANAGEMENT

- A. Comply with Division 1 Section "Construction Waste Management and Disposal."

3.02 POLLUTANT CONTROLS

- A. CALGreen Requirements: Refer to Section 01 81 13 - Sustainable Design Requirements for requirements for temporary ventilation and pollutant control.
1. Comply with CALGreen 5.504.3 regarding covering of duct openings and protection of mechanical equipment during construction
 2. At the time of rough installation and during storage on the construction site until final startup of the heating, cooling and ventilating equipment, all duct and other related air distribution component openings shall be covered with tape, plastic, sheetmetal or other methods acceptable to the enforcing agency to reduce the amount of dust, water and debris which may enter the system. .
 3. Comply with SMACNA Indoor Air Quality (IAQ) Guideline for Occupied Buildings under Construction if permanent heating, cooling, and ventilating systems are in use during selective demolition operations

3.03 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

- A. Comply with SMACNA IAQ Guideline for Occupied Buildings under Construction.
1. If Owner authorizes the use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 1 Section "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
 2. Replace all air filters immediately prior to occupancy. Replacement air filters shall have a MERV 13 according to ASHRAE 52.2.

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3. Contractor must comply with the IAQ Management Plan that Contractor develop and submits. The Plan must meet the SMACNA guidelines referenced herein.

B. Flush Building :

1. Conduct a two-week building air flush-out after construction ends with new air filters and 100 percent outdoor air. Replace air filters after building air flush-out. Replacement air filters shall have a MERV 13 according to ASHRAE 52.2.

3.04 COMMISSIONING

- A. See Section 01 91 13 - General Commissioning Requirements, for commissioning requirements.

END OF SECTION

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SECTION 01 91 00 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Section 220000 – Plumbing General Requirements
- B. Section 230000 – Heating, Ventilating, and Air-Conditioning (HVAC)
- C. Section 250000 – Integrated Automation
- D. Section 260000 – Electrical
- E. In the event of conflict between this Specification and any other Specification(s) regarding system commissioning, the more stringent Specification shall govern.

1.02 RELATED DOCUMENTS

- A. This section includes administrative and procedural requirements with a detailed description of the Commissioning process. Commissioning requirements are found in Part 6, Section 120.8 of the 2019 Title 24 Nonresidential Compliance Manual.
- B. This section supplements other Division 01 Commissioning Sections and applies to equipment listed in Section 1.4 SYSTEMS TO BE COMMISSIONED.
- C. Irrigation commissioning requirements are defined in the CALGreen Section 5.410.2.
- D. Reference to Commissioning activities within this section specifically refers to requirements associated with the Commissioning processes of the 2019 Title 24, ~~LEED-v4~~, and CALGreen and is not intended to replace other commissioning activities that may be contracted.
- E. Commissioning requirements outlined in this Section shall be assigned, as required, to the Owner (or owner's representative), architect, mechanical, electrical, and plumbing engineers, landscape designers, project managers, construction managers, General Contractor, and all subcontractors responsible for equipment to be commissioned.
- F. Commissioning is intended to achieve the following objectives:
 - 1. Verify the Owner's Project Requirements (OPR) are developed and incorporated into the design and construction documents.
 - 2. Verify the Basis of Design (BOD) reflects the OPR and is integrated in the design and construction documents.
 - 3. Verify the submittals for equipment and systems subject to commissioning meet the requirements defined in the BOD, specifications, and construction documents.
 - 4. Verify the applicable equipment and systems are installed according to the manufacturer's recommendations and that they receive adequate operational checkout by installing contractors. Operational checkout is documented by the Installation Verification and

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Startup Checklists that are developed by the Contractors/Vendors and reviewed by the Commissioning Authority.

5. Verify and document that performance of equipment and systems is proper for the application and meet the Owner's operational requirements. Performance of commissionable equipment is generally achieved through the successful completion of the Functional Performance Tests.
6. Verify the Operations and Maintenance (O&M) Manuals are complete.
7. Verify that the Owners' operating personnel are trained in accordance with the specifications.

1.03 DEFINITIONS

- A. Owner's Project Requirements (OPR): A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, and supporting information.
- B. Basis of Design (BOD): A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of proposed systems that support the design process.
- C. Commissioning (Cx) Plan: The Commissioning Plan (Cx Plan) is the roadmap for all activities related to commissioning. Commissioning begins during early design and continues through construction and into the post-occupancy period; therefore this document is intended to provide requirements for both design and construction teams. A preliminary Cx Plan is developed during the early design phase and updated by the CxA as needed throughout the project.
- D. Commissioning Coordinator (CxC): This position is provided through the General Contractor or Owner. Responsibilities include being the point person to coordinate and interface with the Commissioning Authority and subcontractors.
- E. Components, Equipment, Subsystems, and Systems: Where these terms are used together or separately, they shall mean "as-built" components, equipment, subsystems, and systems that are part of the building subject to Commissioning.
- F. Commissioning Authority (CxA): An entity identified by the Owner that plans, schedules, and coordinates the Commissioning Team to implement the Commissioning Process.
- G. Submittal: Documentation that is provided by a contractor for the purpose of confirming equipment and functional operations identified in the Contract Documents.
- H. Installation Verification and Startup Checklists: A written set of checks and tests that document the equipment's readiness, to be completed prior to the equipment's Functional Performance Tests.
- I. Test Adjust Balance (TAB): TAB work is to be completed after all Startup Checklists are reviewed and accepted and prior to Functional Performance Tests. CxA reviews the final TAB report for consistency and compliance with design requirements.
- J. Functional Performance Test (FPT): A documented test of the dynamic functioning and operation of equipment and systems with the goal of verifying that the OPR and BOD are met. Functional

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Performance Testing generally begins with verification of component calibration and proceeds through verification of equipment operations and systems integration.

1. Test procedures are developed and results documented by the Commissioning Authority.
2. Test procedures are executed by the Contractor.
3. Testing occurs once all system components are installed, energized, programmed, balanced, and otherwise ready for operation under part- and full-load conditions. Testing includes each course of action in the Sequence of Operation, including startup, shutdown, capacity modulation, emergency and failure modes, alarms, and interlocks to other equipment.
4. Successful FPTs are predictable and repeatable.

1.04 SYSTEMS TO BE COMMISSIONED

- A. The following systems shall be commissioned:
 1. Heating, Ventilation, Air Conditioning systems (including air handling systems, VAV boxes, exhaust systems, ventilation systems, fan coil units, VRF, environmental refrigerated water systems, environmental heating hot water systems as applicable, all HVAC systems)
 2. Building Automation System (BAS)
 3. Domestic Hot Water Systems
 4. Lighting and Lighting Controls
 5. Irrigation System

1.05 OWNER OR OWNER'S REPRESENTATIVE (OR) RESPONSIBILITIES

- A. Update Owner's Project Requirements (OPR) as operational goals are modified during design.
- B. Provide the OPR documentation to the CxA, design team, and Contractor for information and use.
- C. Schedule operation and maintenance personnel and assign them to participate in Commissioning team activities.
- D. Schedule operation and maintenance personnel and assign them to participate in the training activities on their respective systems.
- E. Assists the CxA in directing the project team, as needed.

1.06 ARCHITECTS RESPONSIBILITIES

- A. May be requested to assist the owner with the development of the OPR.
- B. Respond to design review comments provided by CxA to clarify questions and discrepancies found during the Commissioning Design Review.
- C. Responsible for coordination and management of submittal documentation. Architect ensures that Commissioning Agent receives submittals for review and coordinates team responses.

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1.07 MECHANICAL, ELECTRICAL, PLUMBING (MEP) ENGINEERS AND LANDSCAPE DESIGNER RESPONSIBILITIES

- A. Design engineer shall provide system control diagrams and Sequences of Operations (SoO) in the contract documents. If for some minor systems one is not provided, the design engineer must approve the SoO developed by the controls contractor.
- B. Design Team shall develop and update the BOD, based on changes to the OPR or design.
- C. Design Team shall respond to design review comments provided by CxA to clarify questions and discrepancies found during the Commissioning Design Review.
- D. Review and approve equipment submittals.
- E. Communicate and provide clarification to CxA and contractors as to the operational intent for proper and efficient equipment functioning and integration of systems within the building.
- F. Assist with resolution and clarification of equipment and systems' Sequence of Operations during design and construction.

1.08 GENERAL CONTRACTOR (GC) RESPONSIBILITIES

- A. Include the GC and Sub Contractor cost for commissioning in the total contract price.
- B. Provide a competent person, with 5 years experience in the role of MEP Commissioning Coordinator (CxC).
- C. Incorporate all commissioning activities into the master construction schedule.
- D. Coordinate owner training with subcontractors and commissioning agent.
- E. Attend Post Occupancy review with CxA approximately 10 months after building turnover.
- F. Assist in resolving any warranty issues raised during the Post Occupancy Review.

1.09 COMMISSIONING COORDINATOR (CxC) RESPONSIBILITIES

- A. Provides the point of contact for the Commissioning Authority and subcontractors in the organization, scheduling, coordination, management, and facilitation of the commissioning process.
- B. Responsible for tracking all submittal documentation from subcontractors with the goal of assuring timely processing to and from the CxA.
- C. Delegate commissioning tasks to subcontractors.
- D. Assist in the problem solving of commissioning related issues, to assure the successful completion of Commissioning activities.
- E. Notify the CxA when modifications to Contract Documents occur.

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- F. Ensure subs provide submittals necessary to document and verify equipment is started up and in operational condition to meet the OPR and all Commissioning requirements.
- G. Provide Training Agenda to CxA covering topics necessary to impart information to the building users, maintenance staff, and Owner.
- H. Provide and document training to building users, maintenance staff, and Owner.

1.10 TRADE SUBCONTRACTORS

- A. Each Subcontractor shall assign a representative with expertise and authority to act on its behalf and shall schedule him or her to participate in and perform Commissioning process activities.
- B. Include the cost for commissioning in the contract bid price.
- C. Provide competent personnel to execute commissioning tasks.
- D. Coordinate with GC on scheduling of commissioning tasks and potential conflicts.
- E. Attend Commissioning team meetings held on as needed basis.
- F. Submit equipment submittals and other required documentation for all equipment subject to Commissioning for review by CxA.
- G. Ensure submittals are provided as necessary to document and verify equipment is started up and in operational condition to meet the OPR and all Cx requirements.
- H. Furnish a copy of all construction documents, addenda, change orders, submittals, and shop drawings related to commissionable equipment to the CxA.
- I. Coordinate with equipment vendors for proper documentation and procedures.
- J. Provide Manufacturers' manuals and other supporting documentation described in other sections necessary for the CxA to develop Functional Performance Testing and compile the Systems Manual for Owner.
- K. Provide a copy of all Certificate of Installation (CRCI), Certificate of Acceptance (NRCA), and Certificate of Verification (NRCV) forms to CxA as applicable and required by Title 24 for the CxA to review and approve.
- L. Review, comment, and ultimately accept Functional Performance Test procedures provided by the CxA.
- M. Execute Functional Performance Testing.
- N. Evaluate performance deficiencies identified in the Commissioning Issues Log and in collaboration with the entity responsible for system and equipment installation, and follow on to recommend corrective action.
- O. Provide Training Plan to CxA covering topics necessary to impart information to the building users, maintenance staff, and Owner.

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- P. Provide and document training to the Owner's personnel, which may include building users, maintenance staff, and Owner.
- Q. Provide documentation necessary to fulfill the Title 24 requirements for the Systems Manual.
- R. Provide support to ensure seasonal or deferred functional testing can be executed and witnessed by the CxA, according to the specifications.
- S. Ensure any known deficiencies and deficiencies identified in the commissioning issues log are corrected. Make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing and/or modifications to the original design documents.
- T. Reference Division specific Commissioning Specification for any additional responsibilities.

1.11 CONTROLS SUBCONTRACTORS (CC) RESPONSIBILITIES

- A. Submit equipment submittals and other required documentation for review by CxA.
- B. Attend Commissioning team meetings
- C. Furnish a copy of all construction documents, addenda, change orders, submittals, and shop drawings related to commissioned equipment to the CxA.
- D. Provide list of all schedules, set points, and alarms.
- E. Provide control drawings and Sequence of Operations.
- F. Provide Point-to-Point checks and calibration of all sensors prior to FPTs.
- G. Review, comment, and ultimately accept Functional Performance Test procedures provided by the CxA.
- H. Provide a person capable of performing Functional Performance Test scripts and proper system operation.
- I. Review and execute the FPTs in advance of the CxA witnessing the tests. Report any inconsistencies of expected results to the CxC and CxA.
- J. Execute Functional Performance Testing under the observation of the CxA.
- K. Evaluate performance deficiencies identified in the Commissioning Issues Log and in collaboration with the entity responsible for system and equipment installation, and then follow on to recommend corrective actions.
- L. Provide Training Plan to CxA covering topics necessary to impart information to the building users, maintenance staff, and Owner.
- M. Provide and document training to the Owner's personnel, which may include building users, maintenance staff, and Owner.
- N. Participate in seasonal or deferred functional testing as needed and according to the specifications.

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- O. Provide point trends and assistance with remote access to building automation system.
- P. Reference Division specific Commissioning Specification for any additional responsibilities.

1.12 TAB SUBCONTRACTORS RESPONSIBILITIES

- A. Submit the outline of the TAB plan and approach to the CxA and the BAS contractor when other submittals and contractor documentation is being processed. A full description of the procedures and equipment to be verified, along with the design values, shall be provided.
- B. Coordinate with the commissioning team in the weeks prior to balancing.
- C. Complete air and water balancing, per AABC or NEBB requirements and project specifications.
- D. Identify and report on issues discovered in the field while balancing.
- E. Provide a field copy to CxA prior to functional testing.
- F. Demonstrate TAB results to CxA during Functional Performance Tests.
- G. Coordinate with MEP Coordinator and CxA for resolution of issues.
- H. Provide final TAB reports to CxA and Owner.

1.13 EQUIPMENT VENDOR RESPONSIBILITIES

- A. Provide documentation on furnished equipment, including complete submittals, equipment data, installation manuals, O&M manuals, Control diagrams, Field wiring diagrams, start-up procedures, test results and warranties.

1.14 CxA'S RESPONSIBILITIES DURING CONSTRUCTION

- A. Report results, findings, observations, and recommendations directly to the Owner, in addition to communicating with the Cx Team.
- B. Organize and lead the Commissioning Team.
- C. Provide Commissioning Plan.
- D. Organize and lead Commissioning Team meetings.
- E. Review design documents required for verification of system performance such as control diagrams, Sequence of Operation, single line diagrams, equipment schedules, and specifications.
- F. Review Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews, or as determined by the Owner's Representative or GC.
- G. Review contractor provided documents required for verification of system performance, such as Sequence of Operations, single line diagrams, manufacturers' Installation and Operations Manuals, and Installation Verification and Startup Checklists. Each document will be reviewed,

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approved, and stamped 'approved' prior to submitting to the CxA. Comments are based on adherence to construction documents and manufacturer's requirements.

- H. Review and comment on controls contractor's submittal, actual point-to-point checks, calibration of sensors, dampers, and control actuators.
- I. Review proposed TAB plan and completed reports.
- J. With necessary input and review from installing contractor, write the Functional Performance Tests to be completed by the installing contractor and witnessed by CxA. Additional support may be required of Design Engineers.
- K. Verify the execution of Commissioning process activities using random sampling when appropriate. The sampling rate may vary from 10 to 100 percent. When test results do not meet the requirements, the CxA will report the failure in the Commissioning Issues Log.
- L. Prepare and maintain the Commissioning Issues Log.
- M. Compile test data, inspection reports, and certificates; include them in the Systems Manual and Commissioning Report.
- N. Analyze any functional performance trend logs and monitoring data to verify performance.
- O. Issue final Commissioning Report to Owner.

1.15 COORDINATION

- A. The Commissioning Team includes:
 - 1. Owner or owner's representative (OR)
 - 2. Commissioning Authority (CxA)
 - 3. Architect and Design Engineers (A/E Team)
 - 4. Design Reviewer (DR); for this project the CxA will be DR
 - 5. Project Manager (PM) / Construction Manager (CM)
 - 6. General Contractor (GC)
 - 7. Commissioning Coordinator (CxC)
 - 8. Subcontractors (Subs)
 - 9. Building operator (Operator {includes facilities maintenance representative})
- B. Items listed below require coordination among members of the Commissioning Team. Details regarding these items are provided elsewhere in this Section and discipline specific sections. The activities listed below shall be successfully completed prior to Substantial Completion. Seasonal Tests deemed to be required shall not be a reason to delay Substantial Completion.
 - 1. GC shall submit equipment submittals for equipment listed in Section 1.4.
 - 2. Contractor Documentation for equipment subject to commissioning. GC to submit to CxA for review within 30 days of equipment submittal being approved. Documents are evaluated for conformance to the OPR, BOD, and contract documents and to their operational functionality. Included are:
 - a. Manufacturer's Installation and Operations Manuals
 - b. Control Diagrams (and/or P&IDs)
 - c. Single line diagrams
 - d. Sequence of Operations
 - e. Installation Verification and Startup Checklists

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- f. TAB Plan
3. Equipment Startup (to be performed by the GC and appropriate SUB's)
 - a. Develop and utilize Installation Verification and Startup Checklists.
 - b. Coordinate equipment startup with manufacturers' and/or vendor testing, and other required testing.
 - c. Notify CxA 10 days prior to Startup.
 - d. Provide completed Installation Verification and Startup Checklists 10 days prior to scheduled Test Adjust Balance work.
4. GC shall submit all Point-to-Point check and calibration of all sensors, actuators, dampers, and automatic valves for review by CxA, prior to the start of Test Adjust Balance. Provide completed checklists 10 days prior to TAB.
5. Title 24 Acceptance Tests.
 - a. GC shall complete all required NRCI, NRCA, and NRCV forms, as outlined in the construction documents.
 - b. GC shall submit completed NRCI, NRCA, and NRCV to CxA 10 days prior to scheduled Functional Performance Testing.
6. Test Adjust Balance (TAB): TAB work shall begin by the appropriate contractor after completion of and acceptance of completed Installation Verification and Startup Checklists by the CxA. Notify CxA 10 days prior to Test Adjust and Balance. Submit TAB report to the CxA within 5 days of completion.
7. Functional Performance Testing (FPT): CxA is to develop FPT, then witness and document testing. Completion of Installation Verification and Startup Checklists and TAB reports by Subs and acceptance by the CxA are required prior to scheduling Functional Performance Tests. Coordinate FPT schedule with CxA and CxC.
8. Operations and Maintenance Manuals (O&M): General Contractor shall collect and review O&M documentation and verify it complies with Contract Documentation. GC shall then submit final O&M Manuals for review by CxA at least 10 days prior to training.
9. As-Built Drawings: GC shall provide "redline" or as-built drawings for review by CxA in advance of training activities.
10. Training of building users and operations personnel: GC shall submit training plan to CxA for review and acceptance at least 10 days prior to scheduling training. GC and appropriate SUB's shall provide training to building users and operations personnel at the level necessary to impart the operational knowledge relevant to each group. O&M and as-built documentation is recommended to be included in training of maintenance personnel.

1.16 COMMISSIONING PLAN

- A. The Commissioning Plan (Cx Plan) is a document issued by the CxA to the Commissioning Team in the design phase. The Cx Plan will be updated at various milestones throughout the project. If a conflict exists between the Commissioning Plan and the Specifications, and Contract Documents; the contractor shall ask for clarification on which document takes precedence.
- B. The Cx Plan begins during the design phase of the project. Updates are made throughout the design and construction phase of the project, as necessary.
- C. Cx Plan establishes process guidelines to ensure that the OPR and BOD are met.
- D. Cx Plan includes a commissioning schedule from design through construction and into occupancy.
- E. The Commissioning Plan provides guidance in the execution of the Commissioning process. The Commissioning Plan outlines the specific submittals, reviews, inspections and tests that shall be

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performed as part of the Commissioning process and assigns roles and responsibilities among the Commissioning Team.

- F. Cx Plan shall include the following:
 - 1. General project information
 - 2. Commissioning goals
 - 3. Systems to be commissioned
 - 4. Roles and responsibilities of the members of the Cx Team
 - 5. Cx Team directory
 - 6. Schedule of Cx activities
 - 7. Plan to test systems and components
- G. The Cx Plan shall be issued during early design and implemented throughout the design and construction phases. This document will be updated as needed and then used as a basis for the Commissioning Kick-off Meeting during construction.
- H. The Cx Plan shall be integrated with the GC's overall project schedule.
- I. The Cx plan will be approved by the Owner Representative, an approved plan will be submitted in 1 hard copy and 1 electronic copy to the Owner Representative.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

- A. Contractor shall provide all testing equipment, tools, and instruments required by the Commissioning Process except data logging equipment. If needed, data logging equipment is provided by the CxA.
- B. Submit to CxA a list of test equipment, serial numbers, and calibration certificates expected to be used in the testing process. Calibration certificates shall be dated within 12 months of when equipment is expected to be used or as more restrictive specifications may state in the Contract Documents.
- C. Contractor shall be responsible for disposable materials, e.g. chart/graph paper, recording media, etc. Contractor shall be responsible for all temporary materials, e.g. extension cords, jumper wires, portable sensors, etc.

PART 3 - EXECUTION

3.01 MEETINGS

- A. Construction Commissioning Kick-off Meeting: A Commissioning meeting led by the CxA, shall be held within sixty (60) working days after the Notice to Proceed. Attendance is mandatory for the Construction Commissioning Team. The Cx Plan shall be presented at this meeting.
- B. Controls Integration Meeting: The CxA, CxC, Engineer of Record, CC, and OR (or Owner's designated Facility Representative) may conduct controls integration meeting(s) in coordination with team members as appropriate, including the controls programmer for the project. The meetings shall occur after the software and database drawings are issued for initial review, but prior to the development of the database and code for any piece of equipment.

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- C. Other Meetings: The CxA shall schedule other meetings, generally in conjunction with regularly scheduled site meetings. Meetings shall cover coordination, deficiency resolution, and planning issues.

3.02 COMMISSIONING SUBMITTALS

- A. General Requirements
1. Allow clear space on each submittal for review stamp.
 2. Identify Tag Numbers from construction drawings and or specifications on all submittals.
 3. Commissioning submittal requests shall be integrated into the normal submittal process and protocol of the construction team.
 4. The CxA shall review and comment on submittals related to the equipment to be commissioned for conformance to the Contract Documents as it relates to the Commissioning process, to the functionality of the equipment, and as to the adequacy for developing test procedures.
 5. CxA will provide comments on submittals.
 6. If submittals are incomplete at issuance and require multiple reviews, the Contractor will be billed for additional review time and materials at current billing rates of the CxA.
- B. Equipment Submittals: Specific equipment submittals outlined in the specifications shall be provided to the CxA for review and comment.
1. Manufacturer's standard drawings shall be modified to remove information which is not applicable and shall be supplemented to provide additional information where necessary.
 2. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, and other standard descriptive data shall:
 - a. Have each copy clearly marked to identify pertinent materials, products, models, finishes, etc.
 - b. Clearly show intended options and delete (or strike) options not provided.
 - c. Show dimensions, access points, and clearances required.
 - d. Show performance characteristics and capacities.
 - e. Show wiring diagrams and controls, and show necessary rough-in requirements for utility services and connections, where applicable.
 - f. Include ID Tag numbers as designated on contract drawings.
- C. The following contractor-provided documents are required within 30 days of the approved Equipment Submittal.
1. System Control Diagram (P&ID)s, Documents and Sequence of Operations (SoO). Contractor provides Control Drawings (or Piping and Instrumentation Diagrams {P&IDs}) and narrative description of all control sequences for each component, equipment and system.
 - a. A list of all control points, including analog inputs, analog outputs, digital inputs, and digital outputs. Include the values of all parameters for each system point.
 - b. Provide information (narrative, control drawings, P&IDs) describing the operational modes for all equipment and systems, including startup, shutdown, capacity modulation, emergency and failure modes, alarm scenarios, occupied and unoccupied modes, and interlocks to other equipment.
 - c. Provide SoO and Control diagrams in the same submittal.
 2. Single Line Diagram: Single line drawings identifying equipment and its interconnected relationship to other equipment.
 - a. Provide a single line diagram showing equipment and its relationship to other equipment and systems. This diagram informs the reader of equipment connectivity. Include clear indication of interlocks, safeties, and dependencies.

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- b. Diagrams showing all control points, sensor locations, point names, actuators, and controllers, where necessary.
 - c. Logic diagrams showing the logic flow of the system.
 3. Manufacturer's Installation and Operations Manuals (IOM).
 - a. Provide one copy of the manufacturer's IOM for each unique type of equipment. This manual shall be consistent with the specified approved model. Highlight or cross out sections to illustrate the options and control strategies that are being used for this project. Identify ID Tags on the cover page of each IOM, consistent with design drawings.
 4. Installation Verification and Startup Checklists – Contractor developed checklists designed to verify equipment installation procedures.
 - a. The contractor shall prepare Installation Verification and Startup Checklists as a submittal for each piece of equipment listed in Section 1.4 and submit it for review by the CxA within 30 days of receiving approved equipment submittals (and at least 30 days prior to scheduled startup). The CxA will review these Checklists and may request that additional items be added.
 - b. Installation Verification and Startup Checklists are primarily static inspections and functional procedures to prepare the equipment or system for initial operation (e.g., verification of installation requirements, fan belt tension, labels affixed, gages in place, torque values, sensor calibration, etc.).
 - c. Other startup record forms normally used should also be filled out and submitted at the same time as Installation Verification and Startup Checklists. All documentation should be submitted to the CxA upon completion.
 - d. Manufacturer's recommended checklists shall be part of each contractor's developed Checklist.
 - e. Provide checklists for all components, equipment, sub-systems, and systems.
 - f. Each item shall have a different entry line with space provided for technician's signoff and comments.
 - g. Separate checklists shall be prepared for each piece of equipment, as appropriate.
 - h. Indicate whether the individual verification line item was installed, configured, and calibrated successfully, as defined in the checklist.
 - i. Provide space for all necessary parties to sign off and date the checklist.
 - j. The approved Installation Verification and Startup Checklists are completed by the Contractor and verified by the Commissioning Authority through site visits, inspections, and/or review of the completed Checklists.
 - k. This list of procedures does not constitute a recommendation of the full installation and startup procedures or release the installer from following all factory recommendations, the specifications, applicable codes and good practice.
 5. Test Adjust Balance (TAB).
 - a. Submit a sample TAB Report form for each component, piece of equipment, sub-system, and system requiring testing, adjusting, and balancing; including all interfaces, interlocks, etc.
 - b. Sample TAB report is developed with project specific procedures and equipment and includes all required testing, adjusting, and balancing identified elsewhere in contract documents.
 - c. Provide a detailed description of the Test Adjust Balance procedures and processes.

3.03 SITE INSPECTIONS

- A. Relevant subcontractors shall accompany the Commissioning Authority on up to 2 construction site visits prior to Functional Performance Testing.

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- B. The Contractor shall correct deficiencies found during site visits within 7 days of receiving a corrective action report (Commissioning Issues Logs). A Contractor's written response shall be provided with an explanation describing the corrective measure.

3.04 STARTUP PROCEDURES

- A. Undertake a full startup checkout of each piece of equipment. The startup testing shall be successfully completed prior to formal Functional Performance Testing of that system.
- B. Each piece of equipment receives a full checkout by the Contractor. No sampling strategies are used.
- C. Execution of Installation Verification and Startup Checklists
1. A minimum of 10 days prior to startup, the Subs and/or vendors schedule startup with the CxC and CxA. The startup and initial checkout are directed and executed by the Subcontractor or vendor. The CxA, A/E, and OR may observe the procedures for some or all of the primary equipment.
 2. To document the process of startup, the site technician performing the task initials and dates each line item in the Installation Verification, Startup Checklists, and any manufacturer field startup sheets, as they are completed. Only individuals having direct knowledge of a line item being completed shall check or initial the forms. Each form is to be dated and signed by the person responsible for the Startup.
 3. The Subs and/or vendors submit a signed copy of the completed checklists to the CxA for review.
 4. Installation Verification and Startup Checklists may contain tasks for multiple subcontractors. The primary subcontractor for any particular commissioned equipment is responsible for coordinating sign-off by others.
 5. The subcontractors shall submit the completed documentation to the CxA at least 10 days prior to any TAB or FPT is scheduled.
 6. Provide all manufacturers recommended maintenance to equipment until Final Completion.
 7. Reference Division specific Commissioning Specification for any additional Installation Verification and Startup requirements.

3.05 TEST ADJUST AND BALANCE REQUIREMENTS

- A. Test Adjust Balance (TAB) work is to start after all Installation Verification and Startup Checklists are completed and accepted by CxA. Exceptions may be made if approved by CxA in advance of scheduled TAB.
- B. Notify CxA 10 days prior to scheduled TAB work.
- C. Submit working copy of TAB report to CxA for review as soon as completed.
- D. Submit final TAB Report 10 days prior to FPTs.
- E. Acceptance of TAB report is based on specified deviation from design values. Deviation of $\pm 10\%$ from design value will be used absent of specified values from design engineers.

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- F. A sample set of readings will be taken during Functional Performance Tests to verify final TAB Report. Discrepancies of values greater than $\pm 10\%$ (unless specified elsewhere) for 10% of the sample will be cause to have the TAB Report rejected by CxA.
- G. Reference Division specific Commissioning Specification for additional Installation Verification and Start-up requirements.

3.06 CALIFORNIA TITLE 24 ENERGY STANDARDS ACCEPTANCE TESTING

- A. Acceptance requirements ensure that equipment, controls and systems operate as required by the 2019 California Nonresidential Energy Standards. The activities specified in these requirements have three aspects:
 - 1. Visual inspection of the equipment and installation
 - 2. Review of the certification requirements
 - 3. Functional tests of the systems and controls
- B. Complete and submit a copy of all required NRCI, NRCA, and NRCV forms, as outlined in the construction documents.
- C. A list of Acceptance Tests is found in Appendix A of 2013 Nonresidential Compliance Manual.
- D. The Building Department may require that Certificates of Acceptance are completed and submitted prior to signing off on the final Certificate of Occupancy.
- E. Notify CxA 14 days prior to executing Acceptance Tests.
- F. Acceptance Testing shall be reviewed and approved by CxA.

3.07 FUNCTIONAL PERFORMANCE TESTING REQUIREMENTS

- A. Reference Division specific Commissioning Specifications for any additional Functional Performance Testing Requirements.
- B. Complete the following prior to Functional Performance Testing:
 - 1. Coordinate with the Commissioning Authority to be present during Functional Performance Testing.
 - 2. A minimum of 14-day notice to the CxA is required prior to scheduling the Functional Performance Testing.
 - 3. Review by CxA of the Installation Verification and Startup Checklists, Title 24 Acceptance Tests, and TAB Report.
 - 4. Correction of deficiencies identified during Installation Verification and Startup Checklists. Deficits shall be identified through Commissioning Issues Logs provided by CxA.
 - 5. Provide CxA with access to the record documents. Finalize and make corrections to Record Documents as noted by the CxA prior to Functional Performance Testing.
 - 6. List of any changes to equipment, SoO, and final schedules and setpoints.
 - 7. Provide CxA with remote access to Building Automation System.
 - 8. Review and execute the FPTs in advance of the CxA witnessing the tests. Report any inconsistencies of expected results to the CxC and CxA.
- C. Use only the certified testing equipment provided in the list given to the CxA, as stated in Section 2.1.

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- D. Perform Functional Performance Testing under the observation of the Commissioning Authority who shall record the results of the Functional Performance Test procedures.
- E. Perform all specified tests according to approved testing procedures and the following Control Signal Manipulation requirements:
 - 1. Verify and test performance using actual conditions whenever possible.
 - 2. Simulate conditions by imposing an artificial load when it is not practical to test under actual conditions and when written approval for simulated conditions is received from Commissioning Authority. Before simulating conditions, calibrate testing instruments. Set and document simulated conditions and methods of simulation. After test, return settings to normal operating conditions.
 - 3. Alter setpoints when simulating conditions is not practical and when written approval to do so is received from Commissioning Authority. After tests, return all setpoints back to normal operating conditions.
- F. Deficiencies found during testing shall be recorded on the FPT form and communicated in the Issues Log.
- G. Deficiencies found during testing shall be corrected by the Contractor within 7 days of receiving an Issues Log from the CxA. Deficiencies shall be retested without cost to the owner until accepted by the Commissioning Authority. Where there is a dispute over a deficiency, the Engineer of Record shall be the final authority.
- H. Resolution of minor deficits during Functional Performance Testing may be permissible as determined by the CxA at the point when/where the defect is found.
- I. Deficiencies found during Functional Performance Testing due to inadequate startup are subject to additional services. Contractor will pay CxA on a time and materials basis for retesting.
- J. Problem Solving: The CxA may recommend solutions to problems found, however the burden of responsibility to solve, correct, and retest problems is with the contractor.
- K. The Commissioning Authority shall review and recommend Functional Performance Testing results for approval.
- L. All testing, retesting, and acceptance of Functional Performance Testing shall be completed prior to Substantial Completion. Seasonal Testing may occur after Substantial Completion, where necessary.

3.08 PERFORMANCE TRENDS

- A. Prior to functional testing, the Controls Contractor (CC) shall set up trends on the BAS as specified in the FPTs and/or contract documents. The shall download and submit trend data to the GC, who shall forward it to the CxA for review. The data must be electronic and in spreadsheet or database format.
- B. Remote access, when possible, shall be established prior to functional testing and the CxA shall be given access.
- C. Trends may also be required for review by the CxA during the Post Occupancy Review period.
- D. Trending Requirements

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1. Submit trends for all points listed in Functional Performance Tests. Equipment should be trended during a period similar to design conditions.
2. Trend data must be saved in CSV (Comma delimited) (*.csv) format.
3. All data is to be within the specified trend period for any particular submittal period.
4. Status or Change of Value (COV) data may be saved with other COV data in a single file, but not with Time Series data.
5. Time Series data may be saved with other Time Series data in a single file, but not with COV data.
6. Provide continuous number of specified days of data, 24 hours a day, with time intervals as specified in Functional Performance Tests

3.09 OPERATIONS & MAINTENANCE AND CLOSE OUT DOCUMENTATION

- A. The CxC shall compile all close out documents required by the contract documents, including O&M manuals, equipment warranties, contractor guarantees, and as-builts and verify compliance with the contract documents.
- B. CxC shall forward a complete set of documents to the EOR and Owner for review and approval.
- C. Contractor shall make corrections to the O&M documents within 7 days of receipt of EOR review comments.
- D. The final approved O&M documents shall then be forwarded to the CxA for review in accordance with the contract document requirements. Follow the normal submittal procedure for this submittal.

3.10 SYSTEMS OPERATION TRAINING

- A. Training of the appropriate maintenance staff for each equipment type or system shall be documented for inclusion in the commissioning report.
- B. Training shall include procedures to operate and maintain the building in a cost-effective and energy efficient manner.
- C. Provide a written Training Plan for the targeted audience for review by CxA. Training Plan is to be submitted prior to the completion of Functional Performance Testing.
- D. Submit Training Plan, including a training agenda, proposed schedule with date and length of training, targeted audience, and qualifications of trainer. Send proposed Training Plan to the Owner and CxA for review 2 weeks prior to training. CxA shall review its content and adequacy.
- E. Coordinate training schedule with the CxC.
- F. The O&M manuals shall be available as reference material for the training sessions.
- G. Separate training will be required for building users and owner's maintenance staff.
- H. Instruct Owner's operating personnel in proper starting sequences, operation, shutdown, and maintenance procedures, including normal and emergency procedures. Review the SoO documentation.
- I. Training will include a field demonstration of each piece of equipment.

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- J. Submit a written record of the session, complete with an attendance list (Training Log) to the CxA. The Training Log is to be signed by all attendees. The Training Plan and Training Log are included in the Commissioning Report.
- K. In addition to these general requirements, specific training requirements for commissioned equipment may be specified in other Divisions.

3.11 COMMISSIONING REPORT

- A. General: The Final Report shall be in accordance with 01 78 39 – Master Specification – Requirements for Contractor Turnover Packages. The hardcopy shall be typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by commissioned systems. Content shall be organized by equipment tag numbers and or system name.
- B. The report shall meet Title 24 and ~~LEED~~-v4 requirements.
- C. The report shall include a certification sheet in front of binder signed and shall be sealed by the Commissioning Authority (one per system binder).
- D. For validated systems, an extra copy of all Automation System documentation shall be provided to owner.
- E. The report shall include all relevant system and equipment commissioning data in each system TOP section.
- F. The hardcopy shall be scanned into a .pdf format and delivered to the Owner Representative.

3.12 SYSTEM MANUAL

- A. At the completion of the construction phase commissioning activities, CxA to provide a Systems Manual to the owner for use in operating the building, with Contractor participation.
- B. The Systems Manual is assembled during the construction phase and available during the contractors' training.
- C. This manual is in addition to construction record drawings and Operations and Maintenance Manuals.
- D. Systems Manual shall document the general aspects of the building operations, including:
 - 1. Site information, including facility description, history and current requirements
 - 2. Site contact information
 - 3. Instruction for basic operations and maintenance, including general site operating procedures, basic troubleshooting, recommended maintenance requirements, and a site events log
 - 4. Site equipment inventory and maintenance notes
 - 5. Copy of all special inspection verifications required by enforcing agency or the Standards
 - 6. Owner's Project Requirements
 - 7. Basis of Design
 - 8. System Narrative
 - 9. Single Line Diagrams
 - 10. Test Adjust Balance Report

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11. Schedule for Maintenance
12. Schedule for Retesting / Recommissioning
13. Calibration Schedule
14. Blank Functional Performance Tests

3.13 PROJECT CLOSEOUT

- A. The Commissioning process shall be completed when the systems operate according to the Owner's Project Requirements, Basis of Design, and the Contract Documents, as determined by the CxA.
- B. The Commissioning process may continue past Substantial Completion of the Project, until all non-compliance issues have been resolved. Any remaining deficits are reported to the Owner in the Final Commissioning Report.

3.14 POST OCCUPANCY REVIEW

- A. Approximately 10 months after Substantial Completion (or 10 months after the start of the contractor's warranty), the CxA shall provide a building operations review of the commissioned systems.
- B. The CxA will be available to discuss outstanding Issues Log items and other conditions inconsistent with the functional expectations of the building operations by the Owner's representatives, building users, and maintenance personnel.
- C. The CxA will assist in drafting a plan to remedy outstanding and present issues presented at this review meeting.
- D. A summary report of the Post Occupancy Review will be provided to the Owner.

3.15 COST OF RETESTING

- A. Additional costs incurred by the CxA for retesting systems which used unapproved Startup procedures or completed inadequately during startup may be charged to the Contractor.
- B. Where disputes occur, the Owner shall make the final determination.
- C. Retesting shall not be considered a reason for a claim of delay or for a time extension by the contractor.

3.16 DEFERRED TESTING

- A. Equipment requiring seasonal testing to properly assure equipment operations, as determined by the CxA, shall require the Contractor to perform Functional Performance Testing at a later time. At no time shall the testing extend beyond the warranty period.
- B. Unforeseen Deferred Tests: Checks or tests not completed due to the required occupancy condition, or other conditions may be delayed upon approval of the Owner.
- C. Post Occupancy Review: CxA may require contractor to perform additional testing when results from the Post Occupancy Review suggest components, systems, or system's integration is failing during the warranty period.

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SECTION 01050

GENERAL CONTRACTOR HEALTH & SAFETY

HAZARDOUS MATERIALS DISCLOSURE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Purpose: This section is provided to communicate the following:

1. The presence of regulated environmental materials at the subject project site;
2. The intent of the Peralta Community College District (District) is that all **non-hazardous materials trades** (i.e., general demolition, electrical, mechanical, plumbing contractors, etc.) may not remove, disturb or otherwise accomplish various construction tasks in, on, or around asbestos-containing, lead-containing, or PCB-containing construction materials without proper training, performance of exposure monitoring of employees, and, when required certification and/or licensing.
3. Technical details of the type, location and estimated quantities of regulated environmental materials can be obtained by reviewing the following: Hazardous Materials Specifications 01050, 02010, 02080, 02090 and 02095.

1.2 EXISTING CONDITIONS

- A. Owner's Knowledge - Existing conditions are reflected correctly to the best of owner's knowledge. Should minor conditions be encountered which are not exactly as indicated, modification to new work shall be made as required at no additional expense to owner.
- B. The requirement for exposure monitoring of employees is the responsibility of the employers. This site includes the disturbance, removal, and disposal of lead-containing materials and asbestos-containing materials. Any associated fees for sampling and analyses of exposure monitoring shall be the responsibility of an employer of employees working at the site. Where contractors cannot show recent exposure monitoring (i.e., within the prior 12-months of NTP) of similar projects/tasks for lead and/or asbestos-related work, the contractor and subcontractors shall perform initial exposure monitoring in accordance with Cal/OSHA standards (e.g., 8 CCR 1532.1, 1529, and 5155).
- C. Summary of Regulated Materials - *Results of tests of hazardous materials are available upon request.* Contractor is cautioned that, should interpretations to be made, opinions be formed, and conclusions be drawn as a result of examining the test results, those interpretations, opinions, and conclusions will be those made, formed and drawn solely by Contractor. The below tables

summarize known asbestos containing building components, lead containing building components, and other regulated materials.

D. For hazardous materials, please see:

- a. *Hazardous Building Material Survey Report, Merritt College – Horticulture Complex, Oakland, CA* by Terraphase Engineering, Inc. dated November 19, 2020 (Project No. 0034.017.001)
- b. *Technical Memorandum: Supplemental PCB Sampling – Merritt College Horticulture Greenhouse*, Terraphase Engineering, Inc. dated April 1, 2021

1.3 Demolition Activities: Lead-Related Compliance for all Work

A. When performing trigger task activities, such as facility demolition, manual scraping, sanding, abrasive blasting, welding, cutting, or torch burning where a lead-containing paint or component is present or when employee exposure is expected to exceed the PEL, the contractor shall submit the following:

1. Negative exposure assessment: submit for each task anticipated to disturb lead-containing building materials a negative exposure assessment performed within the past 12 months. Negative exposure assessment submittal to be reviewed for compliance with the requirements of 8 CCR 1532.1 (d)(5)(A) or (d)(5)(b) by the owner's environmental consultant.
2. In lieu of a negative exposure assessment, submit a lead compliance plan meeting the requirements of 8 CCR 1532.1 (e)(2). The lead compliance plan shall include, at a minimum, the following information:
 - a) A description of each activity in which lead exposure is anticipated;
 - b) A description of the specific means, such as work practices and engineering controls, that will be employed to control lead emissions and protect employees;
 - c) A detailed schedule for implementation of the program, including documentation such as copies of purchase orders for equipment, construction contracts, etc.;
 - d) A work practice program which includes selection of PPE and training in its use, cleaning practices to control lead dust emissions, and description of hygiene facilities to be provided to the crew; and
 - e) Methods for creating regulated lead work areas including drawings of any construction barriers and descriptions of signage to be posted.
3. Training:
 - a) Contractors engaged in tasks/activities that disturb lead-containing materials, components and/or finishes, including but not limited to demolition, shall be trained in accordance with 8 CCR 1532.1 (L)(2), which shall include, at a minimum, the following:
 - i. The content of this standard and its appendices;

- ii. The specific nature of the operations which could result in exposure to lead above the action level;
 - iii. The purpose, proper selection, fitting, use, and limitations of respirators;
 - iv. The purpose and a description of the medical surveillance program, and the medical removal protection program including information concerning the adverse health effects associated with excessive exposure to lead (with particular attention to the adverse reproductive effects on both males and females and hazards to the fetus and additional precautions for employees who are pregnant);
 - v. The engineering controls and work practices associated with the employee's job assignment including training of employees to follow relevant good work practices described in Appendix B of this section;
 - vi. The contents of any compliance plan and the location of regulated areas in effect;
 - vii. Instructions to employees that chelating agents should not routinely be used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician; and
 - viii. The employee's right of access to records.
- b) Contractors engaged in activities that have been shown to be or result in exposure to lead at or above the permissible exposure limit (PEL), shall be trained in accordance with Title 17, California Code of Regulations, Section 35040 and as provided in Section 3.3 of this Section.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

3.1 INCIDENTAL DISTURBANCE OF LEAD

- A. Incidental disturbance of lead is defined as work that causes disturbance of lead-containing paint coatings or building components but is not a defined Cal-OSHA trigger task activity.
- B. Workers who will perform incidental disturbance of lead shall be given lead awareness training in compliance with the requirements of 8 CCR 1532.1.
- C. For work tasks where incidental disturbance of lead is anticipated, the contractor shall submit a negative exposure assessment. In lieu of a negative exposure assessment, the contractor shall perform an employee exposure assessment for each task that disturbs lead.
- D. Cleanup of dust and debris from any disturbance of lead shall be performed using wet methods and/or HEPA filtered vacuum equipment. Dry sweeping, use of compressed air, or use of non-HEPA filtered vacuum equipment is prohibited.

3.2 TRIGGER TASK ACTIVITIES

- A. Trigger task activities are defined as those activities listed in section (d)(2)(A), (d)(2)(C), and (d)(2)(D) of 8 CCR 1532.1, including, but not limited to, manual demolition, manual scraping, manual sanding, power tool cleaning with or without local exhaust ventilation, abrasive blasting, welding, and cutting where lead-containing paints or components are present.
- B. Workers who will perform trigger task activities but are not shown to be exposed above the PEL shall be given lead awareness training in compliance with the requirements of 8 CCR 1532.1(l).
- C. Contractor shall submit a negative exposure assessment for each trigger task they will perform.
- D. Where a negative exposure assessment is not available the contractor shall comply with interim protection measures in accordance with 1532.1(2)(E). The interim protection includes the following requirements:
 - 1. Contractor shall submit a lead compliance plan as described in paragraph 1.3 Submittals.
 - 2. Contractor shall implement a medical surveillance program for their workers including, at a minimum, the following blood lead level testing:
 - a) As required to comply with 8 CCR 1532.1(j).
 - 3. Contractor shall provide to all workers PPE including disposable coveralls with booties and hoods. A clean changing area shall be provided for workers to store their street clothing and change into the coveralls.
 - 4. The contractor shall implement a respiratory protection program which is in compliance with ANSI 288.2, 8 CCR 1532.1 and 8 CCR 5144. Workers shall be equipped with, at a minimum, ½ face air purifying respirators with HEPA cartridges or equivalent respiratory protection. Contractor shall select the appropriate respirator in accordance with Cal-OSHA requirements.
 - 5. Hygiene facilities including hot and cold water, soap, and towels for washing up shall be provided in the changing areas.
 - 6. Contractor shall perform an exposure assessment in compliance with 8 CCR 1532.1.

3.3 EXPOSURES ABOVE THE PEL

- A. If any task exposes employees above the PEL, as documented by the contractor's exposure assessment, the contractor shall be required to cease work immediately. The work shall be performed as lead related construction activities in accordance with the requirements of Section 02090.
- B. Any work task that produces documented exposures above the PEL shall be performed inside a contained work area.

- C. All workers performing tasks where exposures are documented to exceed the PEL shall be certified as CDPH lead workers. The supervisor shall hold a current CPDH lead supervisor certification.

END OF SECTION

SECTION 02010

HAZARDOUS MATERIAL SUMMARY OF WORK

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Project Background:

The work under this specification involves the disturbance and/or removal, handling, transportation or disposal of ACM, asbestos-containing construction materials (ACCM) lead-based paint (LBP), lead-containing construction materials, elemental lead components, lighting ballasts, and related regulated components. This specification is meant to be performance based and does provide general guidelines for the contractor.

The contractor shall be responsible for reviewing all specifications, drawings, addenda, hazardous materials reports or other information to determine the impact of construction activities on designated or suspect hazardous material containing building materials. Such hazards shall include, but may not be limited to ACM, lead-containing components, PCB-containing materials, lights and ballasts.

The contractor shall refer to Section 01050 and 02010, existing survey data and associated addenda reports, architect's drawings and specifications and hazardous material plans and/or the Project Manual for details on materials, locations and work requirements.

Should the contractor suspect, encounter or have knowledge of any hazardous materials not listed or described in the contract documents, the contractor shall be responsible for informing the owner via the general contractor and/or the construction manager, immediately and prior to disturbing or causing any action which could result in a release of any suspected or confirmed hazardous material.

The contractor shall be solely responsible for determining quantities that are impacted or may be impacted during the demolition activities described in the contract documents. It is the responsibility of the contractor to be knowledgeable of all federal, state or local regulations and requirements and comply with the most stringent portions of those regulations and requirements. This includes the waste characterization process lead-containing materials.

B. Statement of Work:

1. All hazardous material related sub-contractors and other trades performing tasks requiring hazardous materials training, certification, and/or licensing (contractor) shall furnish all labor, materials, services, permits, waste packaging, waste disposal, insurance (specifically covering the handling and transportation of asbestos-containing material, asbestos-containing construction material, asbestos-containing waste material, lead-based paint, lead-containing waste materials, lead-containing hazardous waste, emergency exit signs containing tritium, mercury-containing thermostats, PCB-containing fluorescent light ballasts, and fluorescent light tubes), and equipment which is specified, shown, or reasonably implied for the following activities:

Summary

Table 1. Summary asbestos-containing materials for the Horticulture complex.

Building	Material/Component	BAAQMD Category	Quantity
Headhouse office restroom	Tan pebble pattern sheet flooring	RACM	20-ft ²
<ul style="list-style-type: none">Janitor's closetHeadhouse office areaClassroom/Lab H101	Black mastic applied to the beige 12-inch vinyl floor tiles	Category I Non-Friable	2,150-ft ²
Headhouse hallway	Black felt paper applied to the glass ceiling	Category I Non-Friable	120-ft ²
Greenhouse	Gray cementitious transite wall panels	Category II Non-Friable	550-ft ²

Table 2. Summary lead-containing materials for the Horticulture complex.

Building	Material/Component	Type	Recommendation
<ul style="list-style-type: none">RestroomHeadhouse	Exterior metal wall flashing	Lead-Based Paint (Brown paint)	Demolition by contractor trained in Lead safe work practices per 1532.1(l)(2), or if applicable 1532.1(l)(3), & waste characterization, and 1532.1(p) notification to Cal/OSHA
Boiler Room and Associated Sheds	wooden overhang of the boiler room and associated sheds	Lead-containing paint (White paint)	Demolition by contractor trained in Lead safe work practices per 1532.1(l)(2), or if applicable 1532.1(l)(3), & waste characterization
Throughout	Fluorescent lights, light ballasts, exit signs, thermostats	Other Regulated Materials	Pre-demolition removal, packaging and recycling

2. Technical Requirements

- In accordance with the technical requirements contained within **Section 02080** of these specifications, remove and dispose of all **asbestos containing material(s)** and **asbestos containing construction material(s)** which are known to be present in the above listed locations and quantities.
- In accordance with the technical requirements contained within **Section 02090** of these specifications, remove and dispose or recycle components identified as **lead-containing material(s)** which are known to be present in the above listed locations and quantities. Lead containing materials may be removed separately prior to general demolition or, at the contractor's discretion with sufficient waste characterization, may be commingled with the general demolition debris. In either scenario Cal/OSHA compliant lead safe work practices and appropriate waste profiling in compliance with Section 02090 are required.
- In accordance with the technical requirements contained within **Section 02095** of these specifications, remove and dispose of all **other regulated material(s)** which are known to be present in the above listed locations and quantities. This includes fluorescent light tubes/ballasts, mercury thermostats (if present), and exit signs with tritium (if present).

d) It is the intent of the owner that lead related construction tasks be carried out in accordance with all applicable laws and regulations. There is no specific requirement for a DOSH licensed contractor to perform the lead-related construction work therefore the contractor may elect to perform the work utilizing any of the following methods of compliance:

- Contractor may hire a subcontractor with CDPH trained and certified workers and supervisors to perform lead-related construction tasks. Said subcontractor shall perform the work in compliance with the requirements of Section 02090 of these specifications.

OR

- Contractor may perform lead-related construction tasks with their own workers or general demolition subcontractors. The general contractor and their subcontractors shall perform the work using Cal-OSHA Lead in Construction compliant lead safe work practices and in accordance with Section 01050 and 02090 of these specifications.

1.2 WORK NOT INCLUDED IN THE CONTRACT DOCUMENTS

- A. Hazardous materials related project oversight and area air monitoring provided by the observation service.

1.3 PROJECT DOCUMENTS

- A. Existing conditions are reflected correctly to the best of owner's knowledge. Should minor conditions be encountered which are not exactly as indicated, modification to new work shall be made as required at no additional expense to owner.
- B. Results of tests of asbestos, lead, and PCB-containing materials taken from building materials within the scope of this project are available for review. However, contractor is cautioned that, should interpretations be made, opinions formed, and conclusions be drawn as a result of examining the test results, those interpretations, opinions, and conclusions will be those made, formed, and drawn solely by contractor.
- C. Owner and observation service make no representation, warranty, or guaranty that the conditions indicated by the test reports either are representative of those conditions existing throughout the area, or that unforeseen developments may not occur, or that materials other than, or in proportions different from those indicated may not exist.
- D. Contractor is advised that the locations of all hazardous materials may not be clearly known and that they shall proceed with caution in all phases of the work. Additional hazardous materials may be uncovered during the course of the work. If any additional hazardous materials are discovered during the course of the work, the contractor shall avoid disturbance and notify the construction manager, general contractor, and environmental consultant to undergo further assessment and direction.

1.4 PHASING

- A. Contractor may be requested to provide access to the building for other trades throughout the duration of the project. Contractor shall coordinate all scheduling and activities with the general contractor.

- B. The contractor may phase each work task (removal of discrete material as described in these contract documents) in any manner it deems reasonable and appropriate. However, contractor may not phase its work such that waste streams are commingled. Further, the contractor may not use processes, introduce agents, materials or otherwise cause a waste to be more toxic by its actions without written approval from the owner.

1.5 STORAGE

- A. Coordinate areas with general contractor.

1.6 BUILDING OCCUPANCY AND ACCESS RESTRICTIONS

- A. Contractor shall comply with all of the owner's access and security requirements.
- B. General contractor or other sub-contractors may enter portions of the facility during the hazardous material related operations. Coordinate work with general contractor and the owner and conduct activities so as to communicate access restrictions.
- C. Excluding regulated work areas, contractor shall maintain access to the subject building in accordance with the owner's access and security requirements at all times.

1.7 WORKING DAYS AND HOURS

- A. All work shall be performed from: Commence activities on: TBD
Complete all activities not later than: TBD
Contractor may work: TBD
- B. Hazardous material abatement work will be performed from: TBD
- C. Hazardous material-free work will be allowed: TBD
- D. Obtain approval from general contractor prior to altering work schedule.

1.8 TELEPHONES

Not used.

1.9 PARKING

Not Used

1.10 BUILDING SECURITY

- A. Maintain personnel on the site at all times when any portion of the work area(s), is open or not properly secured including at hazardous waste transport vehicle. Secure work areas completely at the end of each working day.

1.11 SEGREGATION OF WORK AREAS

- A. Regulated work areas shall be demarcated by appropriate signs and barriers and/or caution tape.

- B. Coordinate with the owner and the general contractor as necessary to restrict access to hazardous materials work areas to authorized personnel.

1.12 PRE-JOB DAMAGE SURVEY OF FACILITY

Not used.

1.13 CORRECTION OF DAMAGE TO PROPERTY

Not used.

1.14 OBSERVATIONS

- A. Observation service will observe the status and progress of the work for completeness and general compliance with the requirements of the contract documents.
- B. Observation service shall verify quantities of materials removed that are conducted on a unit price basis. Items removed that have not been accounted for or otherwise verified by the observation service will be done so at the expense of the contractor.
- C. The owner or observation service will be the parties responsible for addressing issues associated with scope (items included) and technical work practices. However, the observation service will not issue change orders or otherwise provide authorization to proceed on work outside of these contract documents.

1.15 SIGN-IN/OUT LOG

- A. All contractor personnel shall sign-in/out on a daily basis for the duration of the project.
- B. All authorized site visitors shall sign in/out on the entry logs whenever they enter a regulated work area.

1.16 UTILITIES

- A. Contractor shall coordinate with the owner for access to existing permanent utilities during execution of the work. The cost of water and power consumed will be paid by owner. Contractor shall provide, at its own cost, supplementary power and emergency power if it is required by the contractor's means and methods.
- B. Contractor shall provide all lighting necessary to execute the work.

1.17 SALVAGEABLE MATERIALS

- A. Consider all building components and contaminated items demolished or removed in the execution of the work unsalvageable unless specifically noted otherwise in the specifications or drawings.

1.18 FUTURE WORK

- A. Coordinate and schedule the work of these contract documents in a manner that will expedite the transition to future work by others under separate contracts.

1.19 HVAC AND ELECTRICAL SYSTEM

- A. The owner or general contractor's personnel shall shut down and lock out HVAC and electrical systems for each work area. Shut down execution or improper execution does not relieve the contractor of their responsibility to protect his employees, the public and others performing services on the project from injury or electrical hazards. The contractor shall be responsible for performing testing, inspecting and the taking of other precautions to insure the safety of the project.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 02080

ASBESTOS-RELATED WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This section specifies the methods, procedures, and requirements related to the removal and disposal of Asbestos-Containing Material (ACM), Asbestos-Containing Construction Material (ACCM) and Asbestos-Containing Waste Material (ACWM) including, but not limited to:
 - 1. Regulatory requirements
 - 2. Submittals
 - 3. Personal protective measures
 - 4. Execution
 - 5. Inspections
 - 6. Waste handling
- B. Related Sections:
 - 1. Section 01050 – General Contractor Health & Safety: Contract Requirements and Disclosure
 - 2. Section 02010 – Hazardous Material Summary of Existing Conditions
 - 3. Section 02090 – Lead-Related Construction
 - 4. Section 02095 – Other Regulated Materials
 - 5. Hazardous Material Location Figures 1-6
 - 6. Project Manual: Plans and Specifications

1.2 SCOPE OF WORK

- A. The Work of this section includes the provision for all labor, materials, equipment and services necessary to effect the preparation, removal, cleaning, and disposal of asbestos, ACM, and ACCM as indicated by the contract drawings and within Section 01050 and 02010 of this specification.
- B. The work of the contract can be summarized as follows:
 - 1. Section 2010, Section B;
 - 2. Administrative requirements necessary to execute the work, including but not limited to the preparation and delivery of all required submittals;
 - 3. Packaging, transportation, and disposal (including all prescribed, implied or otherwise required waste characterization and analysis) of all regulated, hazardous and non-hazardous materials and components shown, specified or otherwise implied.

1.3 SUBMITTALS

- A. Personnel training: at the pre-construction meeting, contractor shall submit (1) declaration certifying all the contractor's employees have been adequately trained, and (2) a photocopy of

training certificates, for each employee from their respective training agency or organization. Contractor may submit a photocopy of the employee's asbestos worker certification card in lieu of training certificates. All copies shall be legible and in color.

- B. Respirators: submit at pre-construction meeting certifications for each employee and clearly state that each employee has been fit tested and properly trained for respirators.
- C. Medical examinations: submit proof that all persons providing labor and/or professional services who will be entering regulated areas while donning respirators have current (less than one year prior to the date of their participation on the project) medical examinations. Furnish physician's written opinion to the owner's representative at the pre-construction meeting, or prior to each person's commencing work on this project, and for each person subsequently providing labor and/or professional services at the job site for whom a certificate was not initially furnished.
- D. Product submittals and substitutions: comply with pertinent provisions of applicable sections.
- E. Asbestos removal or encapsulation product data: within ten (10) days after contractor has received the owner's notice of award, submit manufacturer's catalogue, samples, safety data sheets, (SDS) and other items needed to demonstrate fully the quality of the proposed materials. Under no circumstances shall proposed materials be used before written approval from the owner, owner's representative or observation service. Submittals are required if the following materials are proposed (not necessarily a complete list). Do not submit data on products not proposed for this project:
 - 1. Encapsulant
 - 2. Surfactant
 - 3. Protective packaging
 - 4. Lagging adhesive
 - 5. Glovebags
 - 6. Solvents
- F. Permits: submit at pre-construction meeting proof satisfactory to the owner, owner's representative or observation service that all required permits have been obtained.
- G. Waste compliance plan: submit ten (10) days before starting work a copy of the waste compliance plan which is in compliance with federal, state, and local hazardous waste regulations and addresses:
 - 1. Identification of hazardous waste streams, if any, associated with the work.
 - 2. Sampling and analysis plan: should the contractor conduct additional waste characterization for disposal purposes, a plan detailing the following elements is required to be submitted and approved:
 - Identification of material(s): location, component, color, substrate;
 - Proposed sample collection methods to be employed;
 - Asbestos containing waste materials may not be commingled or composited prior to sampling;
 - Proposed analytical methods to be used;
 - Proposed analytical laboratory and associated qualifications; and
 - Proposed methods of data interpretation.

3. Estimated quantities of wastes to be generated and disposed of.
 4. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a 24 hour point of contact. Furnish two (2) copies of epa, state, and local permit applications, permits, and epa identification numbers.
 5. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
 6. Spill prevention, containment, and cleanup contingency measures to be implemented.
 7. Name of the EPA approved hazardous waste treatment or disposal facility for asbestos disposal.
 8. Waste streams, excluding ACM, may be segregated or commingled prior to waste characterization at the contractor's discretion. It may be to the contractor's benefit to segregate unique components known or suspected to contain elevated levels of lead.
 - Waste transportation: submit in the waste compliance plan the method of transport of hazardous waste, including the name, address, EPA ID number, and telephone number of the transporter(s).
 - Whenever possible, asbestos containing waste material shall be segregated from other waste streams.
- H. The designated owner's representative shall inspect the waste and sign the uniform hazardous waste manifests and/or waste shipping record prior to transport and disposal. The designated owner's representative is the only person authorized to sign the manifest and shall retain the original last copy of the manifest. A copy of the land ban restriction notification or any required pertinent documentation must also be submitted in order to verify proper disposal.
- I. Asbestos Removal Plan: the contractor shall submit for approval at least ten (10) days prior to the start of work a detailed plan of the work procedures to be used in the removal, repair, clean-up or encapsulation of materials containing asbestos. Such a plan shall include:
1. Location of asbestos work areas.
 2. Layout and construction details of decontamination and enclosure systems.
 3. Project schedule including important milestones, critical paths and interface of trades involved in the work.
 4. Personal air monitoring procedures.
 5. Detailed description of the method to be employed in order to prevent the spread of contamination, including negative air equipment calculations for all negative pressure enclosures.
 6. Names of superintendent, foremen, project manager and other key personnel, and their daytime and emergency telephone numbers.

7. Security plan including sketches necessary to clearly describe the plan.
 8. Emergency evacuation plan for injured workers, fire and other emergencies. Include a list of emergency phone numbers and a route map to the nearest medical facility for emergency treatment.
 9. A contingency plan, in the event of a major contamination incident caused by fire (on or off the floor being abated), a large breach in the work area containment barrier, the opening of stairwell doors, breakage of the building's exterior windows or sabotage. Such a plan will focus on how to maintain safety and order when the building is occupied by other trades or by the owner's personnel.
 10. Negative exposure assessment(s) (NEA): the contractor shall provide any NEA to be utilized on the project along with the required written determination and all air sampling data including laboratory results and the chain of custody or air sampling form used for the NEA. The NEA shall be compliant with the requirements of 8 CCR 1529.
 11. The observation service and owner must approve the asbestos plan in writing at least 5 workdays before the start of any work.
- J. Equipment certification: submit at pre-construction meeting manufacturers' certification that vacuums, negative air pressure equipment filters, and other local exhaust ventilation equipment conform to ANSI Z9.2.
- K. Rental equipment: when rental equipment is to be used in removal areas or to transport waste materials, a copy of the written notification provided to the rental company informing them of the nature of use of the rented equipment shall be signed by the rental company and submitted to the observation service at the pre-construction meeting. The contractor shall submit a decontamination plan for the rental equipment that has been approved, in writing, by the rental company.
- L. Notifications: When required, contact the following government agencies in writing by certified/registered mail overnight mail service, or fax delivered at least ten (10) workdays prior to commencing any disturbance of asbestos:

1. Bay Area Air Quality Management District
2. California Division of Occupational Safety and Health

All notifications shall contain as a minimum the following information:

- a) Name, address and telephone number of the owner including the contact person.
- b) Name, address, EPA numbers, license number and telephone number of the contractor including the contact person.
- c) Name, address and description of the building, including size, age, and prior use of building.
- d) The type and quantity of friable asbestos material involved and the description of the work.

- e) Scheduled starting and completion dates for abatement work.
 - f) Procedures that shall be employed to comply with the regulations.
 - g) The name, address, EPA number and telephone number of the transporter.
 - h) The name and address of the hazardous waste disposal facility where the asbestos waste shall be deposited.
- M. Provide proof of contractor's C-22 license and asbestos certification from the contractor state licensing board, and proof of registration with the division of occupational safety and health in accordance with California Labor Code, Section 6501. Submit proof with bid.
 - N. Respiratory protection program: submit a copy of the contractor's current written respiratory protection program.
 - O. Safety programs: on company letterhead, submit confirmation that contractor has written safety programs for injury illness prevention (mandatory for all projects), hazard communication (mandatory for all projects), fall protection (when applicable), lock out tag out (when applicable), and confined space (when applicable).
 - P. Encapsulant manufacturer's certification (when required) that the contractor is an approved applicator of the encapsulants to be used on this project.
 - Q. Scaffolding: submit to the owner's representative or observation service prior to removal work, certification from a licensed civil or structural engineer that the scaffolding design and installation is safe and adequate for the purpose for which it will be used. Submit copy of scaffolding permit when required by local regulatory agencies.
 - S. Where asbestos cement pipe is to be removed from exterior work areas the contractor shall submit documentation of, at a minimum, 4-hour asbestos cement pipe worker training from an accredited training provider.

1.4 APPLICABLE REGULATIONS AND PUBLICATIONS

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

- A. Federal Regulators and Regulations
 - 1. EPA - Environmental Protection Agency
 - a) 40 CFR, Part 763, Subpart E – AHERA
 - 2. OSHA - Occupational Safety and Health Administration
 - a) 29 CFR 1926.1101 - Asbestos Construction Standard
 - b) 29 CFR 1910.1001 – Asbestos General Industry Standard
 - c) 29 CFR 1926 – Construction Industry Standards

3. NESHAPS - National Emission Standards for Hazards Air Pollutants
 - a) 40 CFR 61, Subpart M - Asbestos Emissions
 - b) 40 CFR 61, Subpart A - General Conditions
 4. DOT - Department of Transportation
 - a) 49 CFR 270-273
- B. State Regulators and Regulations
1. Cal/OSHA - California Department of Occupational Safety and Health
 - a) Title 8 CCR Section 1529 - Construction Asbestos Standard
 - b) Title 8 CCR Section 3203 - Injury and Illness Prevention
 - c) Title 8 CCR Section 5144 – Respiratory Protection
 - d) Title 8 CCR Section 5158 - Confined Space
 - e) Title 8 CCR Section 5194 - Hazard Communication
 - f) Title 8 CCR Section 5208 - General Industry Asbestos Standard
 - g) Title 8 CCR Chapter 4 Subchapter 4 – Construction Safety Orders
 2. DTSC - Department of Toxic Substance Control
 - a) Title 22 CCR Sections 66261.24, 66268.7, 66268.114
 3. CIWMB - California Integrated Waste Management Board
 4. SWQCB - State Water Quality Control Board CCR, Title 23
 5. CSLB - Contractor State Licensing Board
 - a) Business and Professional Code Section 7058.5
- C. Local Regulators and Regulations
1. BAAQMD – Bay Area Air Quality Management District
- D. National Reference Standards
1. ANSI – American National Standards Institute
 - a) Z9.2 – Fundamentals Governing The Design and Operation of Local Exhaust Systems
 - b) Z88.2 – Practices for Respiratory Protection

2. NIOSH – National Institute of Occupational Safety and Health
 - a) Method 7400 – Asbestos and Other Fibers
 - b) Method 7402 – Asbestos Fibers by TEM
3. UL – Underwriters Laboratories
 - a) 586 – Standard for High Efficiency, Particulate, Air Filter Units

1.5 DEFINITIONS

- A. **Owner:** Peralta Community College District
- B. **Abatement:** Asbestos-related work procedures to control fiber release. Includes removal, disturbance, encapsulation, and enclosure.
- C. **Adequately Wet:** A term as defined in 40 CFR Part 61, Subpart M-, and EPA 340/1-90-019- that means to sufficiently mix or penetrate with liquid to prevent the release of particulates. If visible emissions are observed coming from ACM, then that material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wetted.
- D. **Air Lock:** A system for permitting ingress and egress with minimum air movement between a contaminated area and an uncontaminated area.
- E. **Air Monitoring:** The process of measuring the fiber content of a specific volume of air in a stated period.
- F. **Air Sampling Professional:** The professional contracted or employed to supervise air monitoring and analysis schemes. This individual is also responsible for recognition of technical deficiencies in worker protection equipment and procedures during both planning and on-site phases of an abatement project. Acceptable air sampling professionals include industrial hygienists, environmental engineers and environmental scientists with equivalent experience in asbestos air monitoring and worker protection.
- G. **Amended Water:** Water to which a surfactant has been added.
- H. **Area Monitoring:** Sampling of airborne fiber concentrations within the asbestos work area and outside the asbestos work area which are representative of the airborne concentrations of asbestos fibers which may reach the breathing zone.
- I. **Asbestos:** (29 CFR 1926.1101 Definitions) Includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that has been chemically treated and/or altered.
- J. **Asbestos** (California Code of Regulations definitions): Means fibrous forms of various hydrated minerals including chrysotile, (fibrous serpentine), crocidolite (fibrous riebeckite), amosite (fibrous cummingtonite-grunerite), fibrous tremolite, fibrous actinolite, and fibrous anthophyllite.

- K. **Asbestos-Containing Material (ACM)** EPA definition: Material composed of asbestos of any type in an amount greater than 1 percent and by weight, either alone or mixed with other fibrous or nonfibrous materials.
- L. **Asbestos-Containing Construction Material (ACCM)** (California definition): Means any manufactured construction material, which contains more than 1/10th of 1% asbestos by weight.
- M. **Asbestos-Containing Waste Material (ACWM)**: Any waste that contains or has been contaminated by commercial asbestos and is generated by a plant, source, or operation including, but not limited to, asbestos mill tailings, control device asbestos waste, RACM demolition and renovation waste material, disposable equipment and clothing, and bags or containers that previously contained commercial asbestos.
- N. **Asbestos Related Work**: Work that disturbs asbestos fibers or has the potential to release asbestos fibers into the air.
- O. **Authorized Visitor**: The owner's project team members, the owner's representative, observation service and any representative of a regulatory or other agency having jurisdiction over the project.
- P. **Clean Room**: An uncontaminated area or room which is a part of the worker decontamination enclosure with provisions for storage of workers' street clothes and protective equipment.
- Q. **Contained Work Area**: A work area which has been isolated, plasticized, and equipped with a decontamination enclosure system.
- R. **Curtained Doorway**: A device to allow ingress or egress from one area to another while permitting minimal air movement between the areas, typically constructed by placing three overlapping sheets of plastic over an existing or temporarily framed doorway, securing each along the top of the doorway, and securing the vertical edge of the outer two sheets along the opposite vertical side of the doorway.
- S. **Decontamination Enclosure System**: A series of connected rooms, with air locks or curtained doorways between any two adjacent rooms, for the decontamination of workers and of materials and equipment. A decontamination enclosure system always contains at least one air lock to the work area.
- T. **Encapsulant**: A liquid material which can be applied to asbestos-containing material and which controls the possible release of asbestos fibers from the material either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding its components together (penetrating encapsulant).
- U. **Encapsulation**: All herein-specified procedures necessary to apply an encapsulant to asbestos-containing materials to control the possible release of asbestos fibers into the ambient air.
- V. **Enclosure**: All herein-specified procedures necessary to enclose completely asbestos-containing material behind airtight, impermeable barriers with a designed lifespan of twenty or more years.

- W. **Excursion Limit:** An exposure of airborne concentrations of asbestos fibers of one fiber per cubic centimeter of air (1f/cc) as averaged over a sampling period of thirty (30) minutes.
- X. **Equipment Room:** A contaminated area or room that is part of the worker decontamination enclosure with provisions for storage of contaminated clothing and equipment.
- Y. **Equipment Decontamination Enclosure:** That portion of a decontamination enclosure system designed for controlled transfer of materials, waste containers and equipment, typically consisting of a washroom and a waste loadout.
- Z. **Friable Asbestos Material** (40 CFR, Subpart M Definition): Material that contains more than one percent (1%) asbestos by weight and that can be broken, crumbled, pulverized, or reduced to powder by hand pressure when dry.
- AA. **Friable Asbestos Material** (California DTSC): Material that contains equal to or more than one percent (1%) asbestos by weight and that can be broken, crumbled, pulverized, or reduced to powder by hand pressure when dry.
- BB. **Fixed Object:** A unit of equipment or furniture or other building component that cannot be detached from the building or can only be detached by destructive methods resulting in irreparable damage to the item.
- CC. **Glovebag Method:** A method with limited applications for removing friable asbestos-containing material from HVAC ducts, piping runs, valves, joints, elbows, and other non-planar surfaces. The glovebag (typically constructed of six [6] mil transparent plastic) has two inward-projecting long sleeve rubber gloves, one inward-projecting waterwand sleeve, an internal tool pouch, and an attached, labeled receptacle for asbestos waste. The glovebag is constructed and installed in such a manner that it surrounds the object or area to be decontaminated and contains all asbestos fibers released during the removal process. All workers who are permitted to use the glovebag method must be highly trained, experienced, and skilled in this method.
- DD. **HEPA Filter:** A high efficiency particulate air (HEPA) filter capable of trapping and retaining 99.97 percent of all monodispersed particles (asbestos fibers) equal to or greater than 0.3 μ in mass median aerodynamic equivalent diameter.
- EE. **HEPA Vacuum Equipment:** Vacuuming equipment with a HEPA filter system.
- FF. **Land Ban Notification:** The notice and certification form for friable asbestos containing waste certifying that the generator is aware of the regulations governing disposal of RACM and that the designated waste is in compliance with Title 22 CCR Division 4.5 treatment requirements.
- GG. **Moveable Object:** A unit of equipment, furniture or other building component that is detached or can be detached from the building without destructive methods or results.
- HH. **Negative Air Pressure Equipment:** A portable local exhaust system equipped with HEPA filtration and capable of maintaining a constant, low velocity air flow into contaminated areas from adjacent uncontaminated areas.
- II. **Nonfriable Asbestos-Containing Material:** Material that contains more than one (1) percent Asbestos by weight in which the fibers have been locked in by a bonding agent, coating,

binder, or other material so that the Asbestos is well bound and will not release fibers during any appropriate end-use, handling, demolition, storage, transportation, processing, or disposal. Also referred to as miscellaneous, Category I or Category II non-friable asbestos containing material.

- JJ. **Observation Service:** The agent of the owner or the owner's representative who shall observe the work, perform tests, verify that abatement methods and procedures specified by the contract documents are being complied with, and reports all observations and test results to the owner or the owner's representative.
- KK. **Permissible Exposure Limit (PEL):** An airborne concentration of asbestos equal to 0.10 fibers per cubic centimeter of air as an eight (8) hour time-weighted average (TWA), as determined by the method prescribed in Title 8, CCR 1529.
- LL. **Personal Monitoring:** Sampling of airborne fiber concentrations within the personal breathing zone of a worker.
- MM. **Plasticize:** To cover floors, walls and other structural elements of a work area with NFPA approved flame-resistant plastic sheeting as herein specified with all seams securely taped.
- NN. **Removal:** All procedures necessary to remove ACM or ACCM from the designated areas and to dispose of these materials at an acceptable site.
- OO. **Shower Room:** A room between the clean room and the equipment room in the worker decontamination enclosure with hot and cold running water, and suitably arranged for complete showering during decontamination. The shower room comprises an air lock between contaminated and clean areas.
- PP. **Surfactant:** A chemical wetting agent added to water to reduce surface tension and improve penetration.
- QQ. **Wet Cleaning:** The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with amended water (except where prohibited by safety concerns), and by afterwards disposing of these cleaning tools as asbestos-contaminated waste.
- RR. **Work Area (Also known as "Regulated Area"):** Designated rooms, spaces, or areas of the project in which asbestos disturbance or removal actions are to be undertaken or which may become contaminated as a result of such abatement actions. Access to such regulated work areas is limited to appropriately trained and authorized personnel by use of signs, placards, barriers, and other similar devices.
- SS. **Worker Decontamination Enclosure System:** That portion of a Decontamination Enclosure System designed for controlled passage of workers, and other personnel and authorized visitors, typically consisting of a clean room, a shower room, and an equipment room.

1.6 ADMINISTRATION OF THE CONTRACT

- A. All work is to be performed under the scrutiny of the observation service and the owner's representative, who shall be free to review all work.

1.7 SAFETY

- A. Submit at the pre-construction meeting written procedures for evacuation of injured workers. Aid for seriously injured workers shall not be delayed in order to comply with standard decontamination procedures. It is the responsibility of the contractor to decide if the seriousness of the injury warrants noncompliance with the standard decontamination procedures.
- B. The contractor shall have a comprehensive job safety meeting at the beginning of the project with the observation service in attendance. The contractor shall give 72-hours' notice of this job safety meeting. The contractor shall thereafter hold tail-gate safety meetings at a minimum once per week or as required by other Cal-OSHA regulations. The initial and continuing safety meetings shall be conducted in the primary language of its employees. If needed, more than one primary language presentation must occur. The contractor shall keep a record of the topics and persons in attendance. Workers shall each sign an attendance sheet for each safety meeting.
- C. The contractor shall retain licensed and certified personnel to remove equipment from service, including electricians, plumbers, etc., as required. Such additional support personnel shall not engage in disturbing asbestos.

1.8 QUALITY CONTROL

- A. Safety compliance: in addition to detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, state, regional, and local authorities and publications regarding handling, storing, transporting, and disposing of ACWM. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the work. Where the requirements of this specification and referenced documents vary, the most stringent requirement shall apply. When requirements of reference documents vary, the most stringent requirement shall apply.
- B. Before the commencement of any work at the site, the contractor shall post bilingual (as appropriate) EPA and OSHA caution signs in and around the work area to comply with EPA and OSHA regulations.
- C. Area monitoring may be performed by the owner or the observation service at the discretion of the owner. Area monitoring may consist of one or more of the following air sampling activities: (1) at the perimeter of the work area, (2) at the work area entry or waste load-out, or (3) in the work area. If area monitoring results exceed regulatory standards the contractor shall be responsible for adjusting work practices and engineering controls to prevent future exceedances of air quality standards. Where requirements of this specification and regulatory standards vary, the most stringent requirement shall apply.
- D. Clearance testing may be performed at the discretion of the observation service. Contractor shall be notified at least 24 hours prior to completion of work inside a work area that clearance testing will be performed. The contractor shall not remove work area enclosure or shut down engineering controls until written notification of clearance is received from the observation service or the owner. Clearance testing shall generally be performed in accordance with the following protocol; however, the protocol may be altered at the discretion of the observation service:
 - 1. Observation service shall perform a visual inspection of the work area. A visual inspection shall be considered passed when no remaining ACM or ACCM scheduled for removal can be observed and no dust or debris is visible inside the work area. At the discretion of the

owner, a work area may be cleared solely by visual inspection. After visual inspection is passed, the contractor may be required to apply encapsulant to the work area.

2. After encapsulant has been allowed to settle and dry (typically requiring 12-24 hours), the observation service may elect to collect clearance air samples. The observation service shall select the total number of clearance samples needed and location of samples.
 3. Air clearance samples, when collected, shall be analyzed by 40 CFR Part 763, Appendix A to Subpart E TEM Method (TEM-AHERA). When approved in advance, PCM clearance by NIOSH 7400 Method may be used with a minimum air volume of 1,200 liters. NIOSH 7402 Method may be used in conjunction with 7400 Method.
 4. Air clearance samples shall be considered passing when the average concentration of all clearance samples collected inside a single work area does not exceed 70 structures per millimeter squared (70 s/mm^2) by the TEM-AHERA Method.
 5. At the discretion of the owner, when any clearance sample result exceeds 70 structures per millimeter squared, the contractor may be required to re-clean the work area at no additional expense to the owner.
 6. When PCM clearance sampling is used, the clearance criteria shall be a fiber concentration $<0.010 \text{ f/cc}$ for each individual sample. At the owner's discretion, when individual sample(s) exceed 0.010 f/cc , these samples may be re-analyzed by NIOSH 7402 Method. The analytical results of the NIOSH 7402 Method shall take precedence over NIOSH Method 7400 analysis of the same sample.
 7. If the above clearance air sampling thresholds are exceeded, the contractor shall be required to re-clean the subject work area at no additional cost to the owner. Additional air clearance sampling will be performed under the above protocol and any costs to the owner (i.e. laboratory fees, observation service's time, delays to the project) may be back charged to the contractor.
- E. Personal monitoring and other monitoring, which are required by law, or considered necessary by the contractor for worker protection shall be the responsibility of the contractor. The contractor shall submit all personal air monitoring data received. In no event shall results be submitted more than 5 working days from the day of collection.

PART 2 - WORKER PROTECTION

2.1 TRAINING PROGRAM

- A. Each employee shall receive training in the proper handling of materials that contain asbestos, including all aspects of work procedures and protective measures, use of protective clothing and respiratory protection, on use of showers, on entry and exit procedures from work areas and in OSHA regulations. Each employee shall also understand the health implications and risks involved, including the illness possible from exposure to airborne asbestos fibers and the increased risk of lung cancer associated with smoking cigarettes and asbestos exposure, understand the use and limits of the respiratory equipment to be used, and understand the purpose of medical surveillance and the monitoring of airborne quantities of asbestos as related to health and respiratory equipment. The training program shall comply with federal, state and local regulatory requirements.

- B. Emergency evacuation procedures to be followed in the event of worker injury shall be included in worker training program.

2.2 MEDICAL SURVEILLANCE REQUIREMENTS

- A. Before exposure to airborne asbestos, the contractor will provide each employee performing labor or professional services at the project site with a current comprehensive medical exam in compliance with the requirements of California Code of Regulations Title 8, Section 1529. The medical report shall contain a statement from the examining physician that the employee can (or cannot) function normally wearing a respirator or that the safety or health of the employee or other employees will or will not be impaired by his use of a respirator. No employee will be allowed to enter the work area without having first provided a copy of their medical examination, to the owner's representative and until the submitted medical has been approved by the observation service.

2.3 PERSONAL PROTECTIVE EQUIPMENT

- A. Work clothes shall consist of disposable full-body coveralls with hoods, rubber gloves, and safety shoes or equivalent. Sleeves at wrists and cuffs at ankles shall be appropriately secured. Fire retardant full-body coveralls are required in areas of open flame, or where required by local regulations.
- B. Eye protection and hard hats shall be available as appropriate or as required by applicable safety regulations.
- C. Provide authorized visitors with suitable protective clothing, headgear, eye protection, and disposable footwear covering whenever they are required to enter the work area.

2.4 RESPIRATORS

- A. Respiratory protective equipment shall be NIOSH approved in accordance with the provisions of 8 CCR 5144 and 8 CCR 1529 unless superseded by local regulations with more stringent requirements.
- B. Contractor shall maintain a respiratory protection plan in accordance with 8 CCR 5144.
- C. The contractor shall provide workers with approved, permanently personally-issued and marked respirators with changeable filters. The contractor shall provide a enough quantity of filters approved for asbestos so that workers can change filters during the workday. Filters shall not be used any longer than one (1) workday or whenever an increase in breathing resistance is detected. The respirator filters shall be stored at the job site in the Clean Room and shall be totally protected from exposure to asbestos before their use.
- F. Workers shall wear appropriate respirator inside regulated work areas in accordance with 8 CCR 1529 until an NEA for each work task is submitted.

2.5 WORKER PROTECTION PROCEDURES

Bilingual (English and other appropriate language[s]) worker protection procedures must be posted on the job site. If the primary spoken language of all workers is English, the bilingual procedures are exempted.

- A. Contractor shall comply with all required worker safety regulations including, but not limited to, 8 CCR 1529 and 8 CCR Chapter 4, Subchapter 4, Construction Safety Orders.

2.6 EMPLOYEE IDENTIFICATION

- A. The contractor shall furnish an employee roster to the owner's representative for each work shift. Each employee shall bring to the job at least two forms of identification, one of which has his/her photograph.

PART 3 - PRODUCTS

3.1 GENERAL

- A. Contractor shall furnish, provide and utilize the following products in the work as specified.

3.2 PROTECTIVE COVERING (PLASTIC)

- A. Ten (10) mil, six (6) mil, four (4) mil and three (3) mil polyethylene sheets in sizes to minimize the frequency of joints. Protective covering shall be flame retardant.

3.3 TAPE

- A. Duct Tape 2" or wider, or equal, and capable of sealing joints of adjacent sheets of plastic, and for attachment of plastic sheet to finished or unfinished surfaces of dissimilar materials, and capable of adhering under both dry and wet conditions, including use of amended water.

3.4 DISPOSAL CONTAINERS AND BAGS

- A. Appropriately labeled clear, double six (6) mil sealable polyethylene bags as a minimum.
- B. Appropriately labeled, sealable, impermeable drum containers.
- C. Bilingual labels (English and other appropriate language[s]) on containment glovebags, waste packages, contaminated material packages and other containers shall be in accordance with EPA, OSHA, DOT, and DTSC standards.

3.5 WARNING LABELS AND SIGNS

- A. As required by 29 CFR 1910.1101 and CCR Title 8 1529 and other pertinent state and local regulations, whichever is the most stringent.

3.6 NOT USED

3.7 ENCAPSULATING SEALER

- A. Shall be a penetrating or bridging type, pollution-free, nontoxic, with a Class A fire classification as specified herein. Material shall be flexible when cured, resistant to weathering, oxidation, aging and abuse.
- B. Shall be a water-dispensed coating, insoluble in water when cured.
- C. Shall be used undiluted or mixed as directed by the manufacturer.

- D. Shall have a written certification from the manufacturer that the encapsulant is compatible with the replacement material and will safely withstand temperatures of all surfaces on which the encapsulation will be applied.
- E. The owner's representative may at any time take random samples of encapsulant from open containers or spray equipment for testing to ensure product quality and compliance with the specifications.
- F. Encapsulant found not to be in conformance with requirements of these specifications shall be removed from the site immediately. All areas where the defective encapsulant has been applied shall be resprayed with approved encapsulant or remedied in a manner, including the possibility of removal and replacement of the subject ACM, acceptable to the owner. Re-encapsulation expense shall be borne by the contractor.
- G. The contractor shall submit SDS (Safety Data Sheet) for encapsulating sealer to the observation service for evaluation prior to application.

3.8 GLOVEBAGS

- A. The glovebag (typically constructed of six [6] mil transparent plastic) has two (2) inward-projecting long-sleeved rubber gloves, one (1) inward-projecting water wand sleeve, an internal tool pouch, and an attached labeled receptacle for Asbestos Waste.
- B. Glovebag operations shall conform to the procedures in Title 8 CCR 1529.
- C. Two workers shall be assigned per glovebag removal.

3.9 TOOLS AND EQUIPMENT

- A. Provide suitable tools for asbestos removal and encapsulation.
- B. HEPA filtered equipment:
 - 1. All vacuums and negative air pressure equipment shall possess high-efficiency particulate air (HEPA) filtration systems in compliance with ANSI Z9.2, local exhaust ventilation.
 - 2. No air movement system or air filtering equipment shall discharge unfiltered air outside the work area without written approval from the owner.
 - 3. All HEPA filtered equipment shall be "DOP" (or equivalent) tested on-site for all units prior to use.
- C. Manometer:
 - 1. Shall have a built-in alarm. Continuous hard copy readout and data logging required.

3.10 LUMBER

- A. Shall be flame retardant and carrying markings certifying such properties.

3.11 SOLVENTS

- A. Shall be non-toxic, non-carcinogenic, nonflammable (flash-point in excess of 200° F.), non-reactive with or damaging to materials it will come in contact with and approved for indoor use by regulatory agencies. Provide ventilation of work area as required by manufacturer. Vent exhaust to the exterior of the building and in a manner that will not result in adverse effects to other areas of the facility, adjacent facilities or public areas. Solvents shall not be used in areas which food stuffs are stored.
- B. The Contractor shall submit Safety Data Sheets (SDS) for each and every product used on site. Product SDS shall be submitted along with other pre-job submittals prior to commencement of work. No product shall be used or substituted without submitting a current SDS for review and approval by the owner's representative.
- C. Mastic solvents shall be low odor and not leave any objectionable, noxious or toxic odors after use. The contractor shall be responsible for ensuring that solvents do not leave odors.
- D. All costs associated with air quality sampling due to misplacement of exhausts resulting in complaints by adjacent occupied spaces shall be borne by the contractor.

PART 4 - EXECUTION

All Class I, II, and III asbestos work shall be conducted within regulated areas. The regulated area shall be demarcated in a manner that minimizes the number of persons within the area and protects persons outside the area from exposure to airborne asbestos. Where critical barriers or negative pressure enclosures are used, they may demarcate the regulated area. Access to regulated areas shall be limited to authorized persons. The contractor shall ensure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the regulated area. The contractor shall only permit smoking in areas designated by the owner.

4.1 WORK AREA PREPARATION

- A. Preparation procedures for removal of: ALL FRIABLE (RACM), CATEGORY I MATERIALS AND CATEGORY II NON-FRIABLE:
 - 1. Removal of the above or other ACM, unless specified otherwise, shall be executed in a contained or regulated work area.
 - 2. Contractor shall isolate all interior work areas for the duration of the project, completely sealing all openings including, but not limited to, HVAC ducts, diffusers and grilles, skylights, doorways, and windows, with, at a minimum, six (6) mil polyethylene taped securely to a clean surface. Spray adhesive used on finished surfaces should be avoided where possible. [Particular attention shall be paid to the sealing of cracks in the field area openings along the perimeter of the floor, openings at floor/wall intersection adjacent to utility shafts and any other openings in the floor in general that would provide an avenue for water migration. Barriers shall form a seal at vertical walls and at the floor deck above and below.
 - 3. HVAC systems shall be shut down, wherever possible. Contractor shall coordinate with the owner to shut down HVAC systems inside the work area. Contractor shall design his work area preparation and engineering controls as specified and/or as required to prevent damage to and contamination of the affected HVAC system.

4. If the HVAC system cannot be shut down, the isolation system must withstand all foreseeable fluctuations in temperature and pressure. Plastic sheeting and tape alone is insufficient to meet this requirement.
5. Contractor shall remove all movable objects from the work area that are vulnerable to damage or contamination, or that will impede or prevent the completion of the work. All movable objects removed from the work area shall be clean before being moved to the designated storage area.
6. Clean and cover fixed and movable objects that can remain in the work area with six (6) mil polyethylene sheeting taped securely in place. Special precautions shall be taken to protect fixed objects vulnerable to damage or contamination.
7. All fixed and movable objects requiring cleaning shall be washed with amended water and/or cleaned with a HEPA filtered vacuum.
7. Work area (containment): contractor shall cover entire floor, as appropriate, with a minimum of one (1) six (6) mil protective coverings. Cover wall and column surfaces, as appropriate, with a minimum of one (1) four (4) mil protective covering. Floor coverings shall extend a minimum of 12" up vertical surfaces and behind wall covers. All seams shall be staggered and securely taped.
8. Install plexiglass observation window(s) at strategic location(s) in the containment barrier to allow observation of work from outside the work area. Observation windows shall have, at a minimum, an 18" x 18" viewable area. Do not install observation windows at locations accessible to building occupants or the public unless there is no other suitable location.
9. Seal all wall, plumbing, duct and other cavities to prevent asbestos materials from falling into such cavities during the work.
12. The contractor shall check regularly (at beginning, middle and end of each shift as a minimum) all isolation and containment (protective) barriers for punctures, loose seals, contact with heat-generating devices, etc. Problem areas shall be repaired or mended immediately. Visible smoke tubes shall be used to verify containment integrity.
13. Maintain existing emergency exits from the building wherever possible. Emergency exit access shall be coordinated with the general contractor and the owner. Maintain a minimum of two (2) exits from work areas where possible. The first exit shall be through the decontamination enclosure system. The second exit may be the waste load-out or an easily operable emergency only exit in the plastic containment at a door, window or other appropriate location. Exits, where possible, shall be on opposite ends of the work area. All exits shall be labeled in bright letters or signage. The second exit shall be labeled "Emergency Exit Only." Establish alternative exits satisfactory to fire officials where existing building or work area emergency exits are unavoidably blocked by activities of this project.
14. Provide and maintain appropriate fire extinguisher inside and outside the Work Area. [One 30-pound type "ABC" fire extinguisher is required for each 2,000 sq. ft. of floor area.]
15. Install and maintain temporary emergency exit lighting with battery backup power in all work areas. Work areas with adequate natural lighting and no anticipated night work are exempt from this requirement.

16. Electric power inside the work area must be GFCI protected during the wet removal or encapsulation phase of the Project. Provide temporary power and lighting when necessary and ensure safe installation of temporary power sources and equipment per applicable electrical code requirements including appropriate ground fault protection. Temporary light fixtures will be explosion proof. Provide and maintain auxiliary generator equipment where existing facility power is insufficient. Locate generator or vent generator exhaust in a manner that will prevent carbon monoxide hazards to workers and the public. When power shutdown is required, the contractor shall check for conditions where shutdown will pose a danger to the building or to the building's components. Contractor shall take all precautions necessary, including inspections and testing, to ensure the safety of his employees and other building occupants from electrical hazards during the course of the project. Existing fire, smoke detection and other life safety systems shall be kept in operation at all times, or, the contractor shall install and maintain a temporary system or alternate acceptable to the owner and fire officials.
17. The contractor shall install and maintain negative air pressure equipment in all negative pressure enclosures and mini-enclosures during the abatement and decontamination phases of the project. Such equipment shall be kept in operation until the contractor is notified by the owner or observations service that the work area has been cleared. In full negative pressure enclosures, a sufficient amount of air shall be exhausted by the unit(s) to create a pressure of -0.020 inches of water within the work area with respect to the area outside the work area in addition to a minimum of 4-air changes per hour. The contractor shall have a backup unit in place should the working unit fail, and for filter changes.
18. Install and maintain a manometer at every full negative pressure enclosure from the time abatement begins until the contractor receives notification of clearance from the owner or observation service. Provide printouts of the manometer readings (dated & time-stamped) to the owner or observation service upon request.
19. Notify the observation service twenty-four (24) hours in advance of when preparatory steps will be completed. Asbestos abatement work shall not commence until: all preparation requirements have been completed; all tools, equipment, and materials are on hand; all required submittals, notices and permits have been approved, and until the observation service or owner authorizes in writing that work may commence.

B. Preparation procedures for removal of: NON-CLASSIFIED ACCM:

1. Removal of the above or other ACCM, unless specified otherwise, shall be executed in a contained or regulated work area.

4.2 DECONTAMINATION ENCLOSURE SYSTEMS

A. Decontamination enclosure systems (worker and equipment) general requirements:

1. Build suitable wood, metal or PVC framing as needed to support the decontamination enclosure. Framed walls susceptible to damage or which also form a security barrier between Work Areas and public areas shall be protected with a hard barrier such as 3/8" plywood or equivalent. Portable prefab units, if utilized, must be submitted for review and approval by the observation service before start of construction. Submittal shall include, but not be limited to, a floor plan layout complying with the schematic layouts bound herein, showing dimensions, materials, sizes, thickness, plumbing, and electrical outlets, etc.

- B. Decontamination enclosure system for asbestos abatement work in contained work areas for Class I work, or where the exposure levels may exceed the PEL for asbestos:
 - 1. Construct a decontamination enclosure system contiguous to the work area consisting of three enclosed chambers to conform as follows:
 - a) An equipment room with an air lock to the work area and a curtained doorway to the shower room.
 - b) A shower room with two curtained doorways, one to the equipment room and one to the clean room. Plastic on shower room and adjoining equipment and clean rooms shall be opaque. The shower room shall contain at least one shower with hot and cold or warm water. Careful attention shall be paid to the shower enclosure to ensure against leaking of any kind. Trap shower waste using filters having a maximum pore size of 5.0- μ m and drain into a sanitary sewer. Replace filter when they become clogged. Always ensure a supply of soap and disposable towels in the shower room.
 - c) A clean room with one curtained doorway into the shower and one entrance or exit to non-contaminated areas of the building. The clean room shall have sufficient space for storage of the workers' street clothes, towels, and other non-contaminated items. Joint use of this space for other functions, such as offices, storage of equipment, materials, or tools, shall be prohibited.
- C. Decontamination area for asbestos work in regulated work areas for Class II work, Non-Classified ACCM removal or where the exposure levels will not likely exceed the PEL for Asbestos:
 - 1. Construct a decontamination system consisting of one enclosed chamber as follows:
 - a) A clean room with an air lock of sufficient size to allow workers to change from street clothes to protective clothing. The clean room shall also contain means to decontaminate respirators and personnel.

4.3 ASBESTOS REMOVAL - GENERAL

- A. Before removal, asbestos materials shall be sprayed with amended water. The asbestos materials shall be sufficiently saturated without causing excessive dripping and to prevent ambient emission of airborne fibers, at any time, in excess of 0.10 fibers/cc. Spray materials repeatedly during the work process to maintain a wet condition. If the materials are not easily saturated, then the work area shall be constantly misted to keep fiber emission minimal.
- B. Asbestos material shall be removed in manageable sections by a multi-person team, some of whom are wetting and the remainder removing and cleaning. Any material, which falls to the floor shall be wetted and picked up immediately. Material shall not be allowed to dry out. Outside of a full negative pressure enclosure, material drop shall not exceed 5 feet. For heights exceeding 5 feet, provide enclosed dust-proof chutes under negative pressure using HEPA air-filtration devices. Before a second area can be started, removed material shall be packed into approved and labeled packaging while it is still wet. The outside of all containers shall be clean before leaving the work area. Move containers to the waste load-out area, wet-clean each container thoroughly, and remove to uncontaminated areas.

- C. The Contractor shall not remove any asbestos material in one shift than can be cleaned up and properly bagged in labeled 6-mil asbestos bags by the end of the shift. No loose asbestos material may be left in a work area after the end of any shift.
- D. Asbestos material applied to steel decks, beams, columns, pipes, tanks, and other nonporous surfaces, e.g., MEP components, shall be wet-cleaned to a degree that no traces of debris or residue are visible.
- E. Asbestos material debris, drippings, splatters, and overspray on surfaces within ceiling cavities and other accessible areas shall be removed in the same manner and cleaned to the degree as specified above.
- F. The work area shall be kept orderly, clean and clear of work materials, polyethylene sheeting, tape, cleaning material, and clothing. All disposable material or items used in the work area shall be packed into properly labeled protective packaging and removed from the work area for disposal as asbestos waste material.
- G. Protective packages and drums containing asbestos materials shall be cleaned and removed from the work area. Such waste containers shall be stored in labelled, locking storage areas or containers until that time when the materials are to be loaded and hauled to the appropriate waste disposal facility for burial. The packages and drums shall be stored in piles no higher than four (4) feet, and in a manner that will not result in damage to the packages or drums. Transport bags in covered drums or carts from the waste loadout to the storage area or transport. The waste storage area shall be locked at all times when waste is not actively being transported to or from the storage area.
- H. Equipment removal procedures: clean surfaces of contaminated equipment thoroughly by wet-sponging or wiping before removal to uncontaminated areas.
- I. Do not bag water used during abatement activities. Properly filter and drain water into building sanitary drain unless prohibited by local regulations. Filter shall have a maximum pore size of 5.0-µm.

4.4 SPECIFIC ASBESTOS REMOVAL METHODS

- A. Specific control methods for Class I work or work suspected or anticipated to exceed the PEL shall be performed using any or all the following control methods. Methods shall be selected in the contractor's asbestos plan and approved by the owner or observation service.
 - 1. Negative pressure enclosure (NPE) systems: the negative pressure enclosure shall be kept under negative pressure with at least 4 air changes per hour. A minimum of -0.020 column inches of water pressure differential, relative to the outside pressure, shall be maintained and evidenced by manometric measurements. Air movement shall be directed away from the employees and toward a HEPA filtration device. The NPE shall be smoke tested for leaks prior to the start of work and may be tested at any time by the owner or observation service.
 - 2. Mini-enclosure systems: the mini-enclosure system shall be constructed in compliance with 8 CCR 1529 requirements. Visible negative pressure shall be maintained in the mini-enclosure throughout the work and until notified of clearance by the owner or observation service.
 - 3. Glove Bag Systems to remove ACM from straight runs of piping and elbows and other connections.

- a) If the concentration of asbestos fibers monitored outside the glove bag system at any times exceeds 0.010 f/cc or the preabatement level, whichever is greater, work shall be stopped and the owner shall be notified.
 - b) Glove bags shall be made of 6 mil thick plastic, seamless at the bottom and used without modification. Glove bags shall be smoke-tested for leaks and any leaks sealed prior to use. Glove bags shall be used only once and shall not be moved.
 - c) Glove bags shall not be used on surfaces whose temperature exceeds 150 degrees Fahrenheit.
 - d) Prior to disposal, glove bags shall be collapsed by removing air within them using a HEPA vacuum.
 - e) Before beginning the operation, loose and friable material adjacent to the glove bag operation shall be wrapped and sealed in two layers of six-mil plastic or otherwise rendered intact. At least two persons shall perform Class I glove bag removal.
- B. Class II work not anticipated or suspected to exceed the PEL, the following engineering controls and work practices may be used:
- 1. The use of full negative pressure enclosure systems is required for removal of any friable asbestos containing material exceeding 100 square feet.
 - 2. A competent person shall supervise the work.
 - 3. For indoor work, critical barriers shall be placed over all openings to the regulated area.
 - 4. For indoor work, negative pressure in relation to adjacent spaces shall be established and monitored in the work area. At least 4 air exchanges per hour shall be maintained in any enclosed work area. The negative pressure shall be maintained throughout the work and until the contractor receives notification of clearance from the owner or observation service.
 - 5. Impermeable dropcloths shall be placed on surfaces beneath all removal activity.
- C. Non-Classified ACCM demolition or removal work not anticipated or suspected to exceed the PEL, the following engineering controls and work practices may be used:
- 1. A competent person shall supervise the work; DOSH trained workers perform all ACCM work.
 - 2. Provide a dedicated (full-time) worker engaged in dust suppression and water supply to maintain all affected materials, components and debris in an adequately wet state.
 - 3. Remove and/or package all ACCM debris prior to the end of work shift, or fully cover all debris piles with 6-mil fire rated polyethylene sheeting at the end of each work shift.
 - 4. Exterior demolition of ACCM shall not be permitted in conditions where wind speeds exceed 15 mph as averaged over a 30 minute period, or periodic gusts exceed 25 mph.
 - 5. No visible emissions are permitted.

4.5 DECONTAMINATION OF WORK AREA

- A. Decontamination procedures for contained or regulated work areas (Friable, Class I and II and Category I and II non-friable), excluding ACM encapsulation work:
1. Remove all visible accumulations of ACWM and debris. Wet-clean all surfaces within the work area to remove asbestos residue. Wait at least one (1) hour to allow for the settlement of dust, and again wet-clean, or clean with HEPA vacuum equipment, all surfaces within the work area. After completing of the second cleaning operation the contractor shall perform a complete visual inspection of the work area to ensure that the work area is free of contamination.
 2. Sealed drums and bags, and all equipment used in the work area shall be included in the cleanup and shall be removed from the work area via the waste loadout at the appropriate time in the cleaning sequence.
 3. After cleaning, the contractor shall perform a complete visual inspection of the work area to ensure that the work area is free of any visible debris or residue.
 4. Upon completion of the visual inspection, the contractor shall notify the observation service in advance that the work area is ready for the 3rd party visual inspection.

Upon proper notification, the observation service will perform pre-testing visual inspection consisting of two components: review the work area for general conformance with the specifications and close inspection of the work area for any traces of dust, debris, or residue of ACM. The observation service shall notify the contractor of any dust, debris, or residues observed. Any non-conformance of the work shall be remedied by the contractor until the work area is Peralta Community College District

1. Merritt Landscape Horticulture Complex in compliance, and at the contractor's expense. Any remaining dust, debris, or residues shall be removed by re-cleaning by the contractor at the contractor's expense. After re-cleaning, pre-testing visual inspection shall be repeated.
2. Upon successful compliance with the pre-testing visual inspection by the observation service and after notification, the contractor shall encapsulate surfaces where asbestos materials have been removed. Unless specified otherwise, encapsulate those portions of the items where the ACM was located prior to the start of this contract. All surfaces within ceiling, wall, and other accessible cavities where spray-applied or trowel-applied materials have been removed shall also be encapsulated. Apply encapsulant in accordance with the manufacturer instructions. The encapsulant shall be compatible with the existing substrate and replacement materials and shall be rated to safely withstand the temperature of the items to which it will be applied. Encapsulants to be applied to structural members prior to reapplication of spray-applied or trowel-applied fireproofing must be a component of the fireproofing system when it was tested and rated by the Underwriters Laboratory (UL), American Society for Testing Materials (ASTM), Factory Mutual (FM) or other building code approved testing agencies.
3. Upon completion of the encapsulation work, the contractor shall notify the observation service that the work area is ready for clearance testing. Refer to appropriate article on air monitoring in this section for clearance testing standards.
4. Upon written notification from the observation service that the work area has passed the standard for clearance testing, the contractor shall apply, when included in the contract the

asbestos-free replacement materials and reestablish objects and systems as specified in these specifications. The plastic barriers, decontamination enclosure systems, and negative air pressure equipment may be removed by the contractor at any time after written notification of clearance.

4.6 ASBESTOS DISPOSAL REQUIREMENTS

- A. Friable asbestos waste shall be contained in a clear, 6-mil asbestos labeled bag, goose necked and taped. This bag shall be placed into another labeled asbestos bag, goose necked, and taped. A generator identification label shall be affixed to each bag. double bagged, sealed and labeled containers of asbestos waste shall be removed to a secure storage location daily. All asbestos wastes shall be transported to a pre-approved waste site in accordance with the guidelines of 22 CCR Division 4 and 4.5, Hazardous Waste. The owner's designated representative shall inspect the waste and sign the uniform hazardous waste shipping manifests and Land Ban Notification prior to transporting and disposal. The owner's designated representative is the **ONLY** person authorized to sign the manifest and Land ban and shall retain the original generator copy of the manifest. A copy of the Land Ban Notification or any required pertinent documentation must also be submitted in order to verify proper disposal.
- B. Containers removed from the waste load-out must be removed by workers who have entered from uncontaminated areas dressed in clean coveralls. Workers must not enter from uncontaminated areas into the work area; contaminated workers must not exit the work area through the waste load-out.
- C. The contractor shall notify the observation service twenty-four (24) hours, in advance, when RACM are to be removed from the site. The observation service must be present during the removal of RACM from the work area. A copy of the uniform hazardous waste manifest and any other document required by State or Local agencies shall be submitted to the observation service for review prior to transporting RACM to the disposal facility.
- D. At the conclusion of work, the contractor shall provide evidence (such as a bill of lading or hazardous waste manifest and landfill receipt) that the RACM was disposed of at the approved EPA hazardous waste disposal facility. The evidence shall be submitted with the final request for payment. The contractor shall indicate on the bill of lading or hazardous waste manifest the volume, **in cubic yards**, of the RACM generated from the project. This volume amount must be confirmed by a party independent from the contractor.
- E. The contractor shall be responsible for the safe handling and transportation of all hazardous waste generated by the execution of this contract to the designated hazardous waste disposal facility. The contractor shall bear all costs for all claims, damages, losses, and clean up expenses against the owner or the observation service, including but not limited to attorney's fees arising out of or resulting from asbestos spills on the site or spills en route to the hazardous waste disposal facility.
- F. Waste manifest forms shall be provided by the Contractor. Contractor shall coordinate with the owner to ensure that the information in Box 1 (Generator's EPA ID number) and Box 5 (Generators name and mailing address) are complete and correct. If the California Uniform Hazardous Waste Manifest is used the contractor shall include all information necessary to comply with the Federal EPA Waste Shipment Record requirements.
- G. Contaminated clothing and polyethylene shall be disposed of as ACWM.

- H. Waste water from wet stripping, shower room, and worker and equipment decontamination systems shall be filtered through a filtration treatment system capable of removing all particles 5μ or greater in size if it is discharged into the sanitary sewer system. If the wastewater contains regulated constituents not suitable for disposal to a sanitary sewer it shall be disposed of at a permitted facility in accordance applicable laws and regulations.
- I. The work area shall remain under abatement control measures until the observation service has completed final visual inspection and/or air sampling and given approval to dismantle the regulated area.
- J. If requested, the primary polyethylene barrier shall be left in place after abatement as a dust barrier during ensuing non-asbestos construction activities. If contamination cannot be removed from the barrier, the contractor shall remove it and erect a new one in the same location.
- K. All non-disposable equipment, including negative air machines shall be cleaned and decontaminated prior to removal from the regulated area.

4.7 AIR MONITORING AND TESTING

A. Personal Air Monitoring (contractor's responsibility):

- 1. Initial and periodic eight (8) hour TWA and thirty (30) minute excursion limit air monitoring of worker exposures to airborne concentrations of asbestos fibers shall be in accordance with Cal/OSHA (8 CCR 1529) requirements.
- 2. The contractor shall report personal monitoring results to the observation service within 5 working days from the end of the work shift. Worker exposures to airborne asbestos concentrations shall not exceed the Permissible Exposure Limit (PEL) of 8-hour time-weighted average (TWA) of 0.10 fibers per cubic centimeter of air.

4.8 REIMBURSEMENT OF COSTS OF THE OWNER OR THE OBSERVATION SERVICE

- A. In the event that reviews and/or clearance testing by the observation service or regulatory agencies shows that the work area or any portion of the work area is not decontaminated or if the work is not in conformance with the contract documents, the owner, observation service and his consultants will record all time, tests and project-related expenses expended to monitor the work until the work is in compliance. All time, and expenses recorded by the owner, observation service and its consultants to monitor the above work, and all time, tests and project related expenses incurred by the owner and observation service and its consultants outside the project work days, work hours or contract time shall, at the discretion of the owner, be paid for by the contractor. The contractor, promptly upon receipt of the billing from the owner, shall reimburse the owner at the normal billing rate of the owner or the observation service and his consultants, or the owner is authorized to withhold funds from the contract sum, for all time spent by the owner, observation service and his consultants for reviews, testing, and other project related expenses when any of the above conditions occur.

4.9 STOPPING THE WORK

- A. If, at any time, the owner or observation service decides that work practices are violating pertinent regulations, these specifications or, in its opinion, endangering workers or the public, they will immediately notify the contractor (followed up in writing) that operations shall cease until corrective action is taken, and the contractor shall take such corrective action before

proceeding with the work. Loss or damages due to a stop work order shall be borne by the contractor.

END OF SECTION

SECTION 02090

LEAD-RELATED CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This section specifies the methods, procedures, and requirements related to the removal and disposal of lead containing construction materials including, but not limited to:

- | | |
|---------------------------------|-------------------|
| 1. Regulatory requirements | 4. Execution |
| 2. Submittals | 5. Inspections |
| 3. Personal protective measures | 6. Waste handling |

- B. Related Sections:

1. Section 01050 – General Contractor Health & Safety
2. Section 02010 – Hazardous Material Summary of Existing Conditions
3. Section 02080 – Asbestos-Related Work
4. Section 02095 – Other Regulated Materials
5. Project Manual: Plans and Specifications

1.2 SCOPE OF WORK

- A. The work of this section includes the provision for all labor, materials, equipment and services necessary to effect the preparation, removal, cleaning, and disposal of lead-containing paint and components coated with lead paint as indicated by the contract drawings and within Section 02010 of this specification.

- B. The work of the Contract can be summarized as follows:

1. Labor, materials, equipment, supplies, permits, agency notifications, transportation and disposal activities necessary to remove, demolish and/or recycle affected building components including, but not limited to: architectural finishes, structural components as described in Section 02010.
2. Labor, chemical analysis and reporting to support waste characterization of to assess the soluble fraction of Lead and to determine appropriate disposal methods and facilities in accordance with SW 846, 40 CFR 261-265 and Title 22, CCR.

3. Administrative requirements necessary to execute the work, including but not limited to: preparation and delivery of all required submittals, and
4. Packaging, transportation and disposal (including all prescribed, implied or otherwise required waste characterization and analysis) of all hazardous and non-hazardous materials and components shown, specified or otherwise implied.

1.3 SUBMITTALS:

- A. Schedule: submit ten (10) days before starting work and include specific dates and tasks, including worker-loading for the beginning and ending of each phase of the work and dates for testing.
- B. Respiratory protection program: submit ten (10) days before starting work copy of the contractor's respiratory protection plan which is in compliance with ANSI 288.2, 8 CCR 1532.1 and 8 CCR 5144.
- C. Cal/OSHA lead compliance plan: submit a detailed plan of the procedures proposed in order to comply with the requirements of 8 CCR 1532.1. Include in the plan all components required under the standard. Contractor shall submit personal monitoring results to owner's representative weekly. Work tasks for which a negative exposure assessment is submitted (see Section 1.3, D, below) are exempt from this requirement.
- D. Negative exposure assessment: submit for each task anticipated to disturb lead-containing building materials a negative exposure assessment performed within the past 12 months. Negative exposure assessment submittal shall be reviewed for compliance with the requirements of 8 CCR 1532.1 (d)(5)(A) or (d)(5)(b) by the owner's environmental consultant.
- E. Waste Characterization Plan: submit ten (10) days before starting work a waste compliance plan which is in compliance with Title 22, CCR 66261.20 and EPA SW-846 and other relevant and applicable federal, state, and local hazardous waste regulations and addresses:
 1. Identification of hazardous waste streams, if any, associated with the work.
 2. Sampling and analysis plan: should the contractor conduct additional waste characterization for disposal purposes, a plan detailing the following elements is required to be submitted and approved by the owner:
 - a) Identification of material(s): location, component, color, substrate;
 - b) Proposed sample collection methods to be employed;
 - c) Wastes from renovation projects may contain a variety of painted and non-painted components. A method for representative sampling of commingled waste streams shall be included in the sampling and analysis plan;
 - d) Proposed analytical methods to be used;

- e) Proposed analytical laboratory and associated qualifications; and
 - f) Proposed methods of data interpretation.
3. Estimated quantities of wastes to be generated and disposed.
 4. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a 24-hour point of contact. Furnish two (2) copies of EPA, state, and local permit applications, permits, and EPA identification numbers.
 5. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
 6. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
 7. Spill prevention, containment, and cleanup contingency measures to be implemented.
 8. Names of EPA approved hazardous waste treatment or disposal facility for lead disposal.
 9. Written documentation of recycling acceptance from recycling facility of all metal components that will be generated as part of this project.
 10. Waste streams, excluding asbestos containing materials, may be segregated or commingled prior to waste characterization at the contractor's discretion. It may be to the contractor's benefit to segregate unique components known or suspected to contain elevated levels of lead. The separation and commingling of wastes shall be addressed in the sampling and analysis plan including the estimated percent contribution each material to be commingled.
- F. Emergency procedures plan: submit ten (10) days before starting work a copy of the emergency procedures plan. This plan shall be prominently posted in the clean change area. All persons entering the work area shall read and sign the procedures to acknowledge receipt and understanding of the work site layout, location of emergency exits, and emergency procedures.
- G. Hazardous materials demolition contractor qualifications: submit documentation of attendance at a Cal/OSHA compliant lead awareness training course within the last 12 months.
- H. Worker protection records:
1. Training: submit a list of all workers and documentation of attendance at a Cal/OSHA compliant lead awareness training within the last 12 months.
 2. Blood tests: Submit test results within five (5) days of test to observation service.
 3. Daily log: keep a daily log listing workers names and hours worked. Submit a copy to observation service at final clearance.

- 4 Keep a regulated area entry/exit log detailing the names of workers and site visitors who enter the regulated work area and the times of entry/exit. Submit a copy to the observation service at final clearance.

1.4 CLOSEOUT SUBMITTALS:

A. Waste disposal records:

1. A written record of receipts with certified weight/volume for disposal of materials containing lead and lead based paint contaminated items shall be furnished to the owner within forty eight (48) hours after disposal has taken place.
2. Provide a schedule showing date, amount, type of material and location disposed of within five (5) working days of disposal.

1.5 POTENTIAL LEAD HAZARD

- A. The disturbance of lead containing painted building materials may cause lead contaminated dust to be released in to the environment exceeding EPA and CDPH thresholds, thereby creating a potential health hazard to workers and occupants. Ingestion or inhalation of lead contaminated dust can cause various health concerns, including but not limited to nausea, anemia, vomiting, kidney disease, nervous system disorders, and reproductive problems. All contractors, sub-contractors, consultants, and other occupants in the vicinity of a potential lead hazard should be apprised, by the responsible parties and applicable warning signs per OSHA requirements cited herein until the hazard has been corrected.
- B. Significant lead exposure may result from activities such as demolition of components, scraping, sanding, or grinding lead-based paint, abrasive blasting of surface coatings, welding, torch cutting, or related procedures. Where in performance of the work specified herein, there is potential for lead exposure, strict adherence to the measures and procedures of these specifications shall be mandatory.

1.6 REGULATIONS

- A. The contractor shall comply with the requirements of the following regulations and guidelines governing lead abatement and disposal, as well as other applicable federal, state, and local government regulations. The regulations and/or guidelines listed herein are incorporated by reference.
- B. Federal Regulators and Regulations
 1. OSHA - Occupational Safety and Health Administration
 - a) 29 CFR 1926.62 – Lead in Construction Standard
 - b) 29 CFR 1910.1025 – Lead in General Industry Standard

- c) 29 CFR 1926 – Construction Industry Standards
- 2. DOT - Department of Transportation
 - a) 49 CFR 172, 173, 178, & 179 – Hazardous Material Transportation
- C. State Regulators and Regulations
 - 1. Cal/OSHA - California Department of Occupational Safety and Health
 - a) Title 8 CCR Section 1532.1 – Lead in Construction Standard
 - b) Title 8 CCR Section 3203 - Injury and Illness Prevention
 - c) Title 8 CCR Section 5144 – Respiratory Protection
 - d) Title 8 CCR Section 5158 - Confined Space
 - e) Title 8 CCR Section 5194 - Hazard Communication
 - f) Title 8 CCR Section 5208 – Lead in General Industry Standard
 - g) Title 8 CCR Chapter 4 Subchapter 4 – Construction Safety Orders
 - 2. DTSC - Department of Toxic Substance Control
 - a) Title 22 CCR Sections 66261 – Hazardous Waste
 - b) Title 22 CCR Sections 66268 – Landfill Notification/Treatment
 - 3. California Department of Public Health (CDPH)
 - a) Title 17 Division 1, Chapter 8, Work Practices for Lead-Based Paint & Lead Hazards
 - 4. CIWMB - California Integrated Waste Management Board
 - 5. SWQCB - State Water Quality Control Board CCR, Title 23
 - 6. CSLB - Contractor State Licensing Board
 - a) Business and Professional Code Section 7058.5
- D. National Reference Standards
 - 1. ANSI – American National Standards Institute
 - a) Z9.2 – Fundamentals Governing The Design and Operation of Local Exhaust Systems

- b) Z88.2 – Practices for Respiratory Protection
- 2. NIOSH – National Institute of Occupational Safety and Health
 - a) Method 7082 – Lead in air by flame AAS
- 3. UL – Underwriters Laboratories
 - a) 586 – Standard for High Efficiency, Particulate, Air Filter Units

1.7 DEFINITIONS

- A. General: definitions contained in this section are not necessarily complete, but are general to the extent that they are not defined more explicitly elsewhere in the contract documents.
 - 1. **Action level:** An airborne concentration of 30 micrograms per cubic meter (30 µg/m³) of air as an eight (8) hour time weighted average (TWA) as covered by OSHA regulations 29 CFR 1926.62 and Cal-OSHA Title 8, Section 1532.1.
 - 2. **Air monitoring:** the process of measuring the lead levels of a specific volume of air.
 - 3. **Authorized visitor:** The owner, observation service, testing lab personnel, or a representative of any federal, state and local regulatory or other agency having authority over the project.
 - 4. **Personal Breathing zone:** a hemisphere forward of the shoulders with a radius of approximately 6 inches to 9 inches.
 - 5. **Certified Industrial Hygienist (CIH):** a person certified in comprehensive practice by the American Board of Industrial Hygiene and qualified by training and/or experience to specify measures for the recognition, evaluation, and control of occupational health hazards.
 - 6. **Construction barrier:** demarcation of the work area limiting access by unauthorized personnel.
 - 7. **Disposal bag:** A 6 mil. thick leak-tight plastic bag used for transporting lead waste from work area to disposal site.
 - 8. **Elevated blood lead level:** means a blood lead concentration equal to or greater than forty (40) micrograms per deciliter (µg/dl).
 - 9. **Encapsulation:** involves resurfacing or covering surfaces, and sealing or caulking with durable materials, so as to prevent or control chalking, flaking, or damaged lead-containing substances from becoming part of building dust or accessible to occupants.
 - 10. **Enclosure:** the construction of an air-tight, impermeable, permanent barrier around lead-containing material to control the release of lead dust into the air.

11. **Filter:** a media component used in respirators to remove solid or liquid particles from the inspired air.
12. **Final inspection:** inspection by a qualified inspector, industrial hygienist, or local public health official to determine whether lead related work and cleanup are complete.
13. **Hazardous waste:** As defined in 40 Code of Federal Regulation Part 261 - Resource Conservation Recovery Act (RCRA) and Title 22 California Code of Regulations Division 4, the term "hazardous waste" means a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed. Federal and state criteria for hazardous waste levels of lead are as follows:

CA: Total Threshold Limit Concentration (TTLC): $\geq 1,000$ milligrams per kilogram (mg/kg)

CA: Soluble Threshold Limit Concentration (STLC): ≥ 5.0 milligrams per liter (mg/l)

Federal: Toxic Characteristic Leachate Procedure (TCLP): ≥ 5.0 milligrams per liter (mg/l)
14. **HEPA filter:** a high efficiency particulate air filter capable of trapping and retaining 99.97% of particles greater than 0.3μ in diameter.
15. **HEPA filter vacuum collection equipment (or vacuum cleaner):** high efficiency particulate air (absolute) filtered vacuum collection equipment with a filter system capable of collecting and retaining 99.97% of particles of 0.3μ in diameter or larger.
16. **Lead-based paint:** any surface coating with detectable concentration of lead exceeding 5,000 parts per million, 0.5% by weight, or $1.0 \mu\text{g}/\text{cm}^2$ by XRF
17. **Lead containing paint:** any surface coatings containing detectable concentrations of lead.
18. **Lead-containing construction materials:** any building system, lead-containing dust, or component containing detectable concentrations of lead.
19. **Lead permissible exposure limit (PEL):** the employer shall ensure that no employee is exposed to an airborne concentration of lead in excess of 50 micrograms per cubic meter ($50 \mu\text{g}/\text{m}^3$) of air as an eight (8) hour time weighted average (TWA) as covered by OSHA regulations 29 CFR 1926.62 and Cal-OSHA Title 8, Section 1532.1.
20. **Negative pressure:** air pressure lower than surrounding areas, generally caused by exhausting air from a sealed space (work area).
21. **Negative pressure respirator:** a respirator in which the air pressure inside the respiratory-inlet covering is positive during exhalation in relation to the air pressure of the

outside atmosphere and negative during inhalation in relation to the air pressure of the outside atmosphere. Negative pressure respirators include all powered-air purifying respirators (PAPRs).

22. **Negative pressure ventilation system:** a local exhaust system utilizing HEPA filtration capable of maintaining a negative pressure inside the work area and a constant air flow from adjacent areas into the work area and exhausting that air outside the work area.
23. **Observation service:** The owner's contracted environmental consultant.
24. **Personal monitoring:** sampling of lead concentrations within the personal breathing zone of an employee.
25. **Respirator:** a device designed to protect the wearer from the inhalation of harmful atmospheres.
26. **RCRA:** Resource Conservation and Recovery Act of 1976. RCRA is an amendment to the Solid Waste Disposal Act of 1965. RCRA was amended in 1980 and most recently on November 8, 1984 by Hazardous and Solid Waste Amendments.
27. **Testing laboratories:** a "testing laboratory" is an independent entity engaged to perform specific inspections or tests, either at the project site or elsewhere, and to report on, and, if required, to interpret, results of those inspections or tests.
28. **Time weighted average (TWA):** the average concentration of a contaminant in air during a specific time period, typically 8 hours.
29. **Visible emissions:** Any emissions containing particulate lead material that are visually detectable without the aid of instruments. This does not include condensed uncombined water vapor.
30. **Wet cleaning:** the process of eliminating lead contamination from building surfaces and objects by using cloth, mops, or other cleaning utensils which have been dampened with water and afterwards thoroughly decontaminated or disposed of as lead contaminated waste.
31. **Work area:** the area where lead related work or removal operations are performed which is defined and/or isolated to prevent the spread of lead dust, or debris, and entry by unauthorized personnel.
32. **Lead-related construction work:** Any construction, alteration, painting, demolition, salvage, renovation, repair, or maintenance of any residential, commercial or public building, including preparation and cleanup, that, by using or disturbing lead-containing material or soil, may result in significant exposure of adults or children to lead.
33. **(Initial) exposure assessment:** must be performed in all workplaces where employees may be exposed to lead. An assessment of potential exposure to lead as delineated in 8 CCR

1532.1. Until such time that an appropriate, trigger task and job-specific exposure assessment has been conducted, all employers are mandated to provide appropriate respiratory protection, personal protective clothing, change areas, hand washing facilities, biological monitoring and training.

34. **Presumed lead-containing paint:** paint or surface coating affixed to a component in or on a structure, excluding paint or surface coating affixed to a component in or on a residential dwelling constructed on or after January 1, 1979, or a school constructed on or after January 1, 1993.

1.8 OWNERS OBSERVATION

- A. The owner may authorize an observation service to provide the following inspection, testing, and monitoring services including, but not limited to:
1. Wipe lead testing to establish pre-lead work and post lead work lead concentrations.
 2. Visual inspections to verify contractor's compliance with the specifications, as well as applicable regulations, regarding hazard control measures, and related decontamination procedures.
 3. Wipe sampling for lead contamination to determine whether contractor has successfully completed clean-up and met the project decontamination criteria.
 4. Interpretation of technical sections of the contract documents, and coordination with owner and contractor for enforcement of regulatory and contractual conformance, including stop work issues.
- B. The cost of the owner's representative will generally be the responsibility of the owner except under special circumstances. The contractor shall be responsible for the cost of the owner's representative for additional services performed when: a) the contractor's work area fails final clearance inspection and/or testing; or b) additional workdays or workday hours (overtime) are required by the contractor; or c) The contractor exceeds the allowable time frame for completion; or d) additional services associated with response to an uncontrolled, unauthorized release to the environment as a result of the contractor's performance of the work.

1.9 CONTRACTOR QUALIFICATIONS

- A. Competent person: provide a competent person whenever contractor's personnel are on site who is experienced in administration and supervision of lead-related construction projects including work practices, protective measures for building and personnel, disposal procedures, etc. This person is the contractor's representative responsible for compliance with all applicable federal, state and local regulations, particularly those relating to lead-containing materials.
- B. Hazardous materials contractor and subcontractors performing lead related construction work shall use only workers medically qualified and trained for lead work and respirator usage.

1. The supervisor and workers shall have completed lead awareness training in compliance with Cal-OSHA requirements set forth in 8 CCR 1532.1 within the past 12 months. Documentation of attendance at the training shall be submitted for each supervisor and worker prior to the start of work.
2. Contractor shall submit documentation that all employees engaged in lead related construction work have had the appropriate medical examinations within the prescribed time periods immediately preceding project start-up. Documentation shall include, but is not limited to, baseline blood lead levels performed in accordance with 8 CCR 1532.1.
3. Contractor shall submit statement from examining physician that each employee is fit to wear a respirator in accordance with 8 CCR 5144 within the last twelve months.
4. Documentation that all employees have passed respirator fit tests within the past year.
5. The contractor will provide a copy of their lead compliance program specific for this project, as specified in 8 CCR 1532.1 and indicated in Section 1.3 Submittals, above.

PART 2 - PRODUCTS

2.1 PROTECTIVE COVERING

- A. Polyethylene sheets, of 6 mil thickness, in dimensions of adequate width to minimize frequency of joints. All polyethylene sheeting shall be UL listed and certified as fire retardant or non-combustible.

2.2 TAPE

- A. Duct tape, two inches or wider, capable of sealing joints of adjacent sheets of plastic sheeting or for attachment of plastic sheeting to finished or unfinished surfaces.

2.3 CLEANERS

- A. Wet wiping for decontamination shall be accomplished with a detergent wash solution. Alternate cleaning and decontamination agents shall be subject to approval by the owner' representative.

2.4 CHEMICAL PAINT REMOVERS

- A. Chemical remover and all components of the chemical removal system shall contain no methylene chloride products. Chemical removal systems shall be compatible with the painted substrate materials and shall leave the substrate unharmed. The chemical removal system and paint removal procedures shall leave an acceptable smooth surface, capable of receiving an application of the primer/sealer coat without further treatment.

2.5 NOT USED

2.6 SPRAY ADHESIVE

- A. Spray adhesive shall not contain methylene chloride, as listed on the SDS. Provide spray adhesive that is specially formulated to adhere to polyethylene sheeting.

2.7 DISPOSAL CONTAINERS

- A. Provide 6-mil thick polyethylene sheeting, 6 mil leak-tight polyethylene bags and other impervious containers as required by applicable regulations. All waste shall be labeled as potentially hazardous waste unless proven otherwise by appropriate sampling and laboratory analysis.
- B. All hazardous waste shipping containers shall meet federal and California DOT requirements.

2.8 WARNING SIGNS AND LABELS

- A. When employee exposures are shown or expected to be above the PEL, the contractor shall post the following sign at each entry to the regulated work area:

DANGER

LEAD WORK AREA

MAY DAMAGE FERTILITY OR THE UNBORN CHILD

CAUSES DAMAGE TO THE CENTRAL NERVOUS SYSTEM

DO NO EAT DRINK OR SMOKE IN THIS AREA

- B. Hazardous waste labels in accordance with federal, state and local regulations, including, but not limited to the California Code of Regulations, Title 22 Chapter 30 and the U.S. Department of Transportation 49 CFR Parts 172, 173, 178 and 179.

2.9 PERSONAL PROTECTIVE EQUIPMENT

- A. Workers shall wear full body disposable Tyvek® type suits with hoods and booties. Suits may be reinforced with duct tape at the contractor's discretion. Suits will be worn inside the work area after the area passes pre-abatement inspection and shall remain in use until the area passes final clearance inspection. Suits shall be promptly removed and replaced if torn or damaged.
- B. Goggles with side shields will be worn when working with a material that may splash or fragment, or if protective eye wear is specified on the Safety Data Sheets (SDS) for that product.
- C. Respirators and filter types shall be selected in accordance with the requirements of 8 CCR 5144, 8 CCR 1532.1, and the contractor's respiratory protection plan. Additional respiratory protection by supplemental filters, such as organic vapor cartridges, may be needed when handling some coating products. Consult the SDS and obtain the proper filters as necessary.
- D. In addition, all Cal-OSHA requirements, such as hard hats, hearing protection, etc. are required.

2.10 TOOLS AND EQUIPMENT

- A. Provide suitable tools for the decontamination and removal of lead-based-paint including required HEPA vacuums and exhaust units, airless sprayers, ground fault interrupters, hand tools, wipes, ladders, and scaffolds. Mechanical abrasion tools shall be equipped with local HEPA exhaust and subject to approval by the owner's representative. All tools and equipment brought on site shall be clean and free of contamination from lead and other hazardous materials. HEPA filtered equipment shall be labeled with a warning label and dedicated to lead based paint work to prevent combining hazardous wastes of differing characteristics.
- B. Provide adequate support equipment, including, but not limited to lumber, hardware, decontamination showers, sprayers, hoses, drain pans, miscellaneous collection devices, and secure holding facilities.

PART 3 - EXECUTION

3.1 GENERAL

- A. Several levels of preparation and lead removal alternatives are outlined in this section to address various conditions and methods of lead paint and lead containing construction material removal.

3.2 SITE PREPARATION

- A. The level of preparation described in this section is appropriate for removal of lead-containing painted architectural components, and for the removal of wall and ceiling systems containing intact lead based paint as specified in these contract documents.
 - 1. Post Cal-OSHA warning signs, if required by 8 CCR 1532.1, at all immediate entrances to work area.
 - 2. Cover all floors (as possible depending on the materials affected) and non-moveable objects (within 10 feet of the affected area, or otherwise in accordance with applicable lead hazard guidelines) with an appropriate number of layer(s) of 6 mil polyethylene sheeting and seal with duct tape.
- B. Interior work area demolition
 - 1. Post signs as stated above and seal all openings to the work area with a minimum of 6 mil polyethylene sheeting.
 - 2. Close entrances to the work area using a flap-door, z-door, or equivalent temporary airlock system.
 - 3. Remove all moveable objects from the work area.

4. Cover all floors (as possible depending on the materials affected) and non-moveable objects (within 10 feet of the affected area) with appropriate number of layer(s) of 6 mil polyethylene sheeting and seal with duct tape.
5. Pre-clean all horizontal surfaces immediately adjacent to components scheduled for disturbance and protect with 4 mil plastic sheeting and duct tape.
6. Shut down and isolate heating or cooling air handling systems and seal all penetrations within the work area.
7. Notify the owner's representative when the work area is ready for inspection. Lead related work shall not proceed until the owner's representative has inspected and approved work area preparations.

C. Preparation for exterior removal/demolition work

1. Cordon off the work area extending at a minimum of 10 feet horizontally beyond the area of work with barrier tape and warning signs as specified herein.
2. Pre-clean visible suspect lead-based paint dust and debris around and under areas where lead-containing paint or lead containing components will be removed. Use HEPA vacuums and wet methods to perform this cleaning which shall include, at minimum, the designated work area.
3. Cover ground and horizontal surfaces of work area (area within barrier tape) with a minimum of one layer of six (6) mil polyethylene sheeting. Secure the plastic on the building foundation where possible. Horizontal surfaces include scaffolding and/or other work platforms. Extend the plastic from the foundation to 10 feet beyond the work area. Seal all seams with tape and secure plastic to prevent undesired movement.
4. Where lead containing components are likely to generate airborne dust or paint chips, devise a suitable containment to control such dust and prevent dispersal by wind. Exterior removal which generates lead dust and debris shall not be attempted when winds or air currents (i.e., greater than 15 mph) prevent containment of such waste material within the designated work area. To conduct exterior removal under windy conditions, the contractor shall implement special, safe and effective countermeasures to ensure containment of lead dust and debris. These countermeasures include but are not limited to protective shrouds or mini-containments on work platforms.
5. Provide a designated entry/exit point to exterior work areas suitable for workers to properly decontaminate and exit from the work area as specified herein. Install lead caution and warning signage as specified above.
6. Complete any additional preparation work required for the specific abatement method to be used.

3.3 WORKER SAFETY/DECONTAMINATION PROCEDURES

- A. The contractor shall employ only workers medically qualified and trained for lead work and respirator usage.
 - 1. Medically qualified shall mean that the worker has had an occupational medical exam for lead exposure and respirator use within the last 12 months, in accordance with 8 CCR 1532.1, and shall have had a blood lead test within the last 6 months.
 - 2. Each supervisor and worker shall have, at a minimum, completed documented training in lead hazards and lead related work as required by Cal-OSHA 8 CCR 1532.1.
 - 3. The contractor shall assure that no worker is permitted to perform lead disturbing work until the owner representative has received and approved all of that worker's medical, training, and respirator fit test certifications and records.
- B. The contractor shall provide a negative exposure assessment of similar work conducted by similarly trained workers from with the preceding year or perform an initial exposure assessment in accordance with 8 CCR 1532.1. This includes, but is not limited to, collecting personal air samples and producing a written determination of the employees actual exposure to lead dust during construction activities. Personal samples will be collected by the contractor pursuant to OSHA regulations.
- C. Each worker, upon entering the job location, shall proceed to the designated clean room/area and don, at a minimum, a half-mask, negative pressure respirator equipped with HEPA filters, and disposable, full-body, tyvek suit, gloves, and other safety apparel as required (i.e. hard-hats, steel toed shoes, etc.) before entering the work area. The above PPE must be worn during all phases of the paint and/or component removal process. This PPE must be worn for the duration of this project, **or until a negative exposure assessment is approved for the subject work task documenting that worker exposure to lead does not exceed the action level (30µg/m³).**
- D. All disposable clothing worn in each work shift shall be HEPA vacuumed and removed prior to exiting the work area and shall be properly segregated and placed in containers for non-hazardous disposal. Workers shall then proceed to the designated wash station before removing respirator to adequately wash face, hands, arms, etc.
- E. All tools and equipment shall be decontaminated by HEPA vacuuming and/or wet wiping prior to being taken out of the work area.
- F. Workers shall not eat, drink, smoke, or chew gum or tobacco at the work site.
- G. At a minimum each worker shall have blood lead testing in compliance with Cal-OSHA 8 CCR 1532.1 requirements.

- H. The contractor shall provide all workers, supervisors, and superintendents with properly fitted respirators approved by NIOSH and OSHA at no cost to worker. Authorized visitors (i.e. federal, state and local inspectors) must provide a current medical report certifying they are approved to wear respirators. When respirators and disposable filters are employed, sufficient replacement filters will be provided by the contractor for the workers and any visitors. All workers must be properly trained in the care, use and maintenance of respirators. The contractor is responsible for requiring worker fit tests within the last year.

The minimum respiratory protection required for this project while performing trigger tasks will be a half mask, air purifying respirators, equipped with HEPA filters for airborne lead dust, and in accordance with Section 2.09. This requirement is exempted if a negative exposure assessment is submitted for the work task.

- I. Contractor will perform air monitoring as required by 8 CCR 1532.1 in order to determine 8-hour TWA of lead dust to which any worker may be exposed. The 8-hour TWA for any worker shall not exceed the following:

Permissible exposure limit lead: $50\mu\text{g}/\text{m}^3$ for the 8-hour TWA.

3.4 GENERAL REMOVAL PROCEDURES (THE PROCEDURES INCLUDED HEREIN ARE NOT PRESENTED IN A REQUIRED PHASED APPROACH)

A. Dismantling/replacement

1. Prepare work site and provide protective measures in accordance with Section 3.2, above.
2. Building components to be dismantled shall be carefully removed in manageable sections and all work shall be performed over protective polyethylene sheeting. Workers shall exercise caution to avoid release of lead contaminated dust into the air. Do not saw or cut the materials unnecessarily. Dismantling operations shall be conducted in a careful, safe manner, insuring that intact lead-based paint remains so.
3. Based upon the contractor's waste compliance plan they may choose to separate building components with intact, well grounded lead-based paint from other accumulated debris. Collect small debris off dropcloth and place in 6 mil bags for appropriate storage in the designated waste storage area.
4. Properly decontaminate the work area in accordance with procedures outlined in Section 3.3, above.

B. Hand scraping

1. Prepare work site and provide protective measures in accordance with Section 3.2 above.
2. Assure that dropcloths or protective flooring plastic are secured to building and that seams are adequately sealed with tape.

3. After all site preparation is complete and approved by the owner's representative, spray the affected surfaces with a fine mist of amended water before scraping begins. Using appropriate tools, scrape loose and flaking lead containing paint so as to carefully collect all paint chips on the dropcloth.
4. Throughout the procedure, constantly wet the surfaces and debris to minimize the potential for airborne dust.
5. Periodically collect accumulated debris into appropriate 6 mil plastic bags. When all loose paint within a specified work area has been removed or at the end of the shift, seal the waste containers and place in the designated waste storage area.
6. Remove protective plastic sheeting and decontaminate work area in accordance with procedures outlined in Section 3.3, above.

C. Gross removal of lead containing components

1. Remove any associated non-lead containing hardware or construction interference (electrical and telephone utilities, conduit, piping, etc.) as required and store in construction area until final disposition is determined by the owner.
2. Mist affected surfaces prior to starting removal and as needed throughout the removal process to control dust. Remove lead containing components as specified herein and by the contract specifications and drawings. Take care to avoid damage to adjacent components or surfaces scheduled to remain in place.
3. Special precautionary controls shall be used as necessary to prevent lead dust or debris from being carried or blown out of the controlled area by wind or air currents.
4. Each component shall be carefully lowered to the ground, not dropped or thrown. Clean up dust and debris as removal proceeds.
5. Once removed, remove or flatten any remaining fasteners and wrap the lead containing component in six (6) mil polyethylene bags or other appropriate leak-tight container, seal with duct tape, wet-wipe and transfer to secure waste storage for recycling or disposal .
6. HEPA vacuums and wet-wiping shall be used to ensure any resulting lead dust, paint chips or debris have been cleaned up from horizontal surfaces and polyethylene sheeting prior to moving ladders, scaffolding, worker-lifts or other working platforms to the next work area.

E. Removal of lead containing ceramic tile

1. Remove any associated non-lead containing hardware or construction interferences (casework, fixtures, partitions, utilities etc.) as required and store in construction area until final disposition is determined by the owner's representative.
2. Remove lead-containing ceramic tile where specified herein and by the contract drawings.

Maintain dust suppression practices, such as wet methods, throughout the removal work.

3. Special precautionary controls shall be used as necessary to prevent lead dust or debris from being carried or blown out of the controlled area.
4. Using appropriate tools begin to remove the lead containing ceramic tile starting from the highest point. Continue removing the lead containing ceramic tile being careful to prevent lead dust or ceramic tile debris from being carried or blown out of the controlled area. Maintain dust suppression practices throughout the removal process. Take necessary precautions to avoid damage to adjoining walls and/or associated surfaces.
5. Clean up dust and debris as removal proceeds.
6. Once specified components are removed, remove or flatten any protruding materials and place the ceramic tile debris in six (6) mil polyethylene bags or other appropriate leak-tight container, seal with duct tape, wet-wipe and transfer to secure waste storage for waste characterization.
7. HEPA vacuums and wet-wiping shall be used to ensure any resulting lead dust and ceramic tile debris have been cleaned up from horizontal surfaces and polyethylene sheeting prior to moving ladders, scaffolding, man-lifts or other working platforms to the next work area.

3.5 INSPECTION PROCEDURE WORK AREA CLEARANCE

- A. After the final clean-up, a preliminary visual inspection will be conducted by the contractor to ensure that all visible dust and debris has been removed. After the contractor verifies the work area is clean and free of visible dust or debris the owner's representative shall perform a visual clearance inspection. The contractor shall provide the owner's representative at least 24 hours' notice of anticipated completion of work to allow prompt scheduling of the inspection.
- B. If the work area is not visibly clean, as determined by the visual inspection by the owner's representative, the contractor shall re-clean and decontaminate as described in Section 3.3, at its own costs, until the work area passes inspection.
- C. At the discretion of the owner, one or more of the following criteria shall be selected as the clearance standard for each work area. Clearance criteria include:
 1. No visible debris
 2. Interior Floors: <40 µg/ft² lead
 3. Interior Horizontal Surfaces: <250 µg/ft² lead
 4. Exterior Horizontal Surfaces: <400 µg/ft² lead
 5. Native Soil: ≤400 parts per million lead (TTLC)

- D. A work area shall be considered cleared only after all areas within the work area have met the selected criteria.
- E. If a work area fails the clearance criteria selected from those specified above, the contractor shall be responsible to re-clean the area at no additional cost to the owner and shall be responsible for associated additional re-inspection costs, including laboratory fees.

3.6 WASTE HANDLING AND DISPOSAL

- A. The contractor shall provide for secure on-site storage of lead related waste. Waste storage location, equipment, containers and methods shall be in compliance with the requirements of 40 CFR 262 and 265 and California Code of Regulations Title 22.
- B. The owner's representative has determined through sampling and analysis, that various building components contain lead. These items have been presented in the Section 02010 and the associated hazardous material abatement plans which are part of these documents. Waste profiling sampling has not been performed.
- C. The contractor shall remove, handle and dispose of all listed building components containing detectable concentrations of lead. Lead containing waste shall be profiled and disposed of in accordance with the contractor's approved waste compliance plan and California Title 22 and Federal RCRA regulations. Lead-containing components that are not otherwise classified as hazardous waste, may be disposed of as a non-regulated lead containing construction waste at an approved landfill.
- D. Contractor's shall conduct waste characterization to determine the soluble characteristics of identified waste streams may be performed. Such additional sampling and analysis shall be performed in accordance with its approved Plan as provided in Section 1.3E of this Section. The contractor shall provide all laboratory results 3 days in advance of offhaul for review and comment. The contractor shall not proceed with its own waste characterization without achieving written approval from the owner's representative.
- E. To the extent that the contractor chooses option 3.6D, above, all waste containers and packaged waste shall be stored in a designated, secure waste storage area and labeled "PENDING ANALYSIS" with the following information:
 - 1. Waste category (chip/dust and removed components)
 - 2. Date accumulated
 - 3. Name and address of owner
 - 4. Origin of waste
- F. The contractor is responsible for all costs associated with characterization and landfill profiling of waste.

G. DISPOSAL

1. The contractor shall submit name, address, and telephone number of landfill or landfills and transporter to observation service for approval, prior to disposal. This includes those landfills used for waste categories determined to be non-hazardous.
2. The contractor shall have all waste transported from the site in accordance with the requirements of 40 CFR 263 and 264, and disposed of properly in accordance with 40 CFR 268, 49 CFR Parts 172, 173, 178, and 179 and California Code of Regulations Title 22.
3. The contractor shall prepare waste shipping manifests for review by the owner. The manifests shall be signed by the duly authorized representative of the owner and copies retained by the owner.
4. Copies of the landfill weight tickets shall be provided to the owner to verify the amount of waste disposed of at the site.
5. The contractor is responsible for all costs associated with transportation and disposal of the waste.
6. Waste manifest forms shall be provided by the contractor. Contractor shall coordinate with the owner to ensure that the information in Box 1 (Generator's EPA ID number) and Box 5 (Generators name and mailing address) are complete and correct.

H. RECYCLING

1. Contractor shall coordinate with the owner for the recycling of all removed elemental lead components.

3.7 STOP WORK ORDERS

- A. The owner or owner representative has the authority to stop work if it is determined that conditions or procedures are not in compliance with the work plan and/or applicable regulations; the contractor is deficient in providing required submittals; the waste is not securely stored; or a potential release of lead dust to outside the work area is imminent based on the owner's or the owner's representative's judgment.
- B. The work stoppage shall remain in effect until conditions have been corrected and corrective measures have been taken to the satisfaction of the owner and/or owner's representative.

END OF SECTION

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SECTION 02095

PCB BALLASTS, UNIVERSAL WASTES, ORMs

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The scope of work involves the removal, handling, staging, disposal and/or recycling of universal wastes, other regulated materials (ORMs), and hazardous wastes as identified in the solicitation and contract documents. Removal, handling, staging, disposal and/or recycling of these materials shall be performed in strict accordance with all applicable federal, state and local regulations.
- B. Related sections:
 - 1. Section 01050 – General Contractor Health & Safety:
 - 2. Section 02010 – Hazardous Material Summary of Work
 - 3. Section 02080 – Asbestos-Related Work
 - 4. Section 02085 – Non-liquid PCB Material Removal
 - 5. Section 02090 – Lead-Related Construction
 - 6. Project Manual: Plans and Specifications

1.2 SCOPE OF WORK

- A. The work of this section includes the provision for all labor, materials, equipment and services necessary to affect the preparation, removal, and disposal of other regulated materials (ORMs).
- B. The work of the contract can be summarized as follows:
 - 1. Administrative requirements necessary to execute the work, including but not limited to: preparation and delivery of all required submittals;
 - 2. Packaging, transportation and disposal (including all prescribed, implied or otherwise required waste characterization and analysis) of all hazardous materials, universal wastes, and non-hazardous materials and components shown, specified or otherwise implied.

1.3 TRAINING, PERMITS, LICENSES AND NOTIFICATIONS

- A. The contractor shall be responsible for obtaining all training, permits, certifications and notifications required for the safe removal, handling, disposal and/or recycling of these materials. All contractor and subcontractor personnel must have completed all required federal, state and local training and hazard communication prior to work. The contractor shall also obtain and

submit documentation that disposal and recycling facilities have all required permits and certifications, as required by federal, state and local laws and regulations.

1.4 SUBMITTALS

A. The contractor shall submit a detailed plan of action describing the methods to be utilized to accomplish the work. Plan shall include, at a minimum:

- | | |
|-----------------------------------|------------------------------------|
| 1. lockout/tagout, | 4. personal protective equipment, |
| 2. emergency spill procedures, | 5. location of staging area, |
| 3. hazard communication training, | 6. signage and control procedures. |

Contractor shall coordinate signing of all manifests with the owner's designated representative and shall provide copies upon request of all manifests, weight tickets, receipts and/or statements that all materials have been properly disposed and/or recycled.

B. The owner's designated representative shall inspect the waste and sign the uniform hazardous waste shipping manifests prior to transporting and disposal. The owner's designated representative is the **ONLY** person authorized to sign the manifest and shall retain the original last copy of the manifest.

C. Waste compliance plan: submit three (3) days before starting work copy of waste compliance plan which is in compliance with federal, state, and local hazardous waste regulations and addresses:

1. Identification of universal wastes, ORMs, and hazardous waste streams, if any, associated with the work.
2. Sampling and analysis plan: should the contractor conduct additional waste characterization for disposal purposes, a plan detailing the following elements is required to be submitted and approved:
 - Identification of material(s): location, component, color, substrate;
 - Proposed sample collection methods to be employed;
 - Wastes from renovation projects may contain a variety of PCB or mercury containing components. A method for representative sampling of the waste streams shall be included in the sampling and analysis plan;
 - Proposed analytical methods to be used;
 - Proposed analytical laboratory and associated qualifications and;
 - Proposed methods of data interpretation.
3. Estimated quantities of wastes and recyclable materials to be generated and recycled or disposed.
4. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a 24 hour point of contact. Furnish

two (2) copies of EPA, state, and local permit applications, permits, and EPA Identification numbers.

5. Names and qualifications (experience and training) of personnel who will be working on-site with universal wastes, ORMs, and/or hazardous wastes.
6. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
7. Spill prevention, containment, and cleanup contingency measures to be implemented.
8. Names of EPA approved hazardous waste treatment or disposal facility for ORM disposal.
9. Written documentation of recycling acceptance from recycling facility of all metal components that will be generated as part of this project

1.5 PERSONNEL PROTECTIVE EQUIPMENT (PPE)

- A. The contractor will take all necessary precautions to ensure that employees are not exposed to hazardous conditions. Employees shall utilize personal protective clothing, eye protection and hand protection when handling hazardous materials. Contractor shall provide suitable hand/face and eye wash stations as required by 8 CCR Section 4, Construction Safety Orders.

PART 2- PRODUCTS

Not Used

PART 3 – EXECUTION

3.1 PHASING OF WORK - SEQUENCE AND EXECUTION

- A. Phase 1, salvage operations (includes removal and recycling), shall commence prior to Phases 2 (non-recyclable material removal) and 3 (demolition) in accordance with the owner's written Notice to Proceed letters.
- B. Shut down and lock out electric power to all work areas as necessary. (The contractor shall be allowed to use existing power in the building to the extent that it is available for use.) The contractor shall provide temporary power and lighting, and ensure safe installation of temporary power services and equipment, as specified in applicable electrical code requirements.
- C. Contractor shall isolate all electrical sources from lighting fixtures, emergency lighting, switches, gauges, pumps, vacuums, mechanical equipment, etc. prior to removal of ballast's, light tubes, oils, fluids, etc. Responsibility to coordinate scheduling of these areas to be shut down or disconnected will be the responsibility of the contractor.
- D. Prepare staging areas for temporary placement of hazardous materials, as necessary, by covering the floor with at least one (1) layer of 6-mil plastic sheeting (as a drop cloth), taped down. Segregate and separate recyclables and different waste streams at all times. Label and isolate staging areas as necessary. Staging location must be pre-approved by the owner/owner's representative.

3.2 PCB BALLAST, PCB TRANSFORMERS, MERCURY SWITCHES, MERCURY THERMOSTATS, BATTERY OPERATED EXIT SIGNS, BATTERY OPERATED EMERGENCY LIGHTS, AND FLUORESCENT LIGHT TUBES

- A. The Contractor shall remove lamps from fixtures. Lamps shall remain intact (unbroken) and shall be placed carefully into cardboard containers designed to hold lamps (preferably obtained from the manufacturer or lamp recycling facility). Special care shall be taken not to break tubes during, removal, handling and transport.
- B. The contractor shall HEPA vacuum and thoroughly decontaminate any areas where lamps are accidentally broken.
- C. The contractor shall visually inspect light ballasts and transformers. Ballasts and transformers labeled “No PCB’s” will be placed in an on-site receptacle and disposed of as construction debris. All other unlabeled PCB-containing ballasts and transformers will be removed and placed into 55-gallon steel drums (17C or 17H) or other DOT-approved container appropriately labeled in accordance with EPA and DOT regulations.
- D. The Contractor shall wrap any leaking ballasts in 6-mil plastic disposal bags and place in a separate steel drum (17C or 17H). Light fixtures containing leaking PCB-containing ballasts shall also be disposed as PCB waste. Each disposal drum will have a sufficient amount of oil absorbent material placed in the bottom to contain any oil from ballast’s that may leak during transport. Any materials that come in contact with leaking PCB wastes shall be considered contaminated and disposed of as PCB waste.
- E. The contractor shall safely cut wires and remove any existing mercury switches. All switches shall be double bagged in 6 mil plastic prior to disposal.
- F. Transport all properly containerized lamps, ballasts, switches, batteries, and transformers to an approved recycling facility or disposal facility. The contractor shall be responsible for determining and complying with all current applicable regulations pertaining to waste handling and transport of PCB-containing ballast’s and transformers, lead containing batteries, and mercury switches and mercury-containing lamps. The original waste shipment record documenting proper transport, recycling, disposal, or incineration of unrecycled components (i.e., PCB-containing solids and liquids) shall be completed and submitted to the observation service upon project completion. No hazardous wastes will be stored at the project site for more than 90 days from the date of first accumulation.

3.3 DISPOSAL

- A. The Contractor shall submit name, address, and telephone number of recycling, disposal facility or landfills and transporter to observation service for approval, prior to disposal. This includes those landfills used for waste categories determined to be non-hazardous.
- B. The owner’s designated representative shall inspect the waste and sign the uniform hazardous waste shipping manifests prior to transporting and disposal. The owner’s designated representative is the **ONLY** person authorized to sign the manifest and shall retain the original last copy of the manifest.
- C. The contractor shall have all waste transported from the site in accordance with the requirements of 40 CFR 263 and 264, and disposed of properly in accordance with 40 CFR 268, 49 CFR Parts 172, 173, 178, and 179 and California Code of Regulations Title 22.

- D. Copies of the landfill weight tickets shall be provided to the owner to verify the amount of waste disposed of at the site.
- E. The contractor is responsible for all costs associated with transportation and disposal of the waste.
- F. Waste manifest forms shall be provided by the contractor. Contractor shall coordinate with the owner to ensure that the information in Box 1 (Generator's EPA ID number) and Box 5 (Generators name and mailing address) are complete and correct.

END OF SECTION

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SECTION 02 41 13 – SELECTIVE SITE DEMOLITION

PART 1 GENERAL

1.01 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. Additional information concerning earthwork may be found in the geotechnical investigation report; Geotechnical Design Geological Hazards Evaluation Report Horticultural Center Merritt College, August 7, 2020 by Terraphase Engineering, available by request. All requirements of this report shall be followed unless noted otherwise.
- C. Stormwater Pollution Prevention Plan prepared by the Contractor.

1.02 SUMMARY

- A. Section includes:
 - 1. Demolition and removal of existing site features. Refer to Section 02 41 19 for additional requirements.
 - 2. Abandoning in place or removing below-grade construction.
 - 3. Disconnecting, capping or sealing, and abandoning in-place or removing site utilities.
 - 4. Salvaging nonhazardous demolition and construction waste.
 - 5. Recycling nonhazardous demolition and construction waste.
 - 6. Disposing of nonhazardous demolition and construction waste.
- B. Related Sections:
 - 1. Section 01 56 39 – TEMPORARY TREE AND PLANT PROTECTION
 - 2. Section 01 74 19 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
 - 3. Section 02 41 16 – BUILDING DEMOLITION
 - 4. Section 02 41 19 – LANDSCAPE SELECTIVE DEMOLITION
 - 5. Section 31 11 00 – CLEARING AND GRUBBING
 - 6. Section 31 22 00 – EARTHWORK AND GRADING
 - 7. Section 31 23 33 – TRENCHING BACKFILLING AND COMPACTING
 - 8. Section 31 25 00 – EROSION AND SEDIMENTATION CONTROLS
- C. Definitions
 - 1. Abandon: Detach from all connecting structures or pipelines and leave in place, below grade only. In the case of utility lines, cap or otherwise plug all connections with lines to remain in service, and fill or plug the section(s) to be abandoned in accordance with these specifications.
 - 2. Demolish: Completely remove and legally dispose of off-site at a location and route approved by the City of Oakland.
 - 3. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
 - 4. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
 - 5. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having

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jurisdiction.

6. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
7. Salvage: Recovery of demolition or construction waste for subsequent sale or reuse in another facility. The Contractor shall take all reasonable measures to protect elements for salvage from damage during removal, storage and transport.
8. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work. Contractor shall take all reasonable measures to protect elements for salvage from damage during removal, storage and transport.

1.03 REFERENCES

- A. ANSI A10.6 – Safety and Health Program Requirements for Demolition Operations.
- B. Caltrans Standard Specifications Section 19, Earthwork.
- C. NFPA 241 – Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.04 PRE-DEMOLITION MEETING

- A. Refer to Section 02 41 19 LANDSCAPE SELECTIVE DEMOLITION for requirements.

1.05 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. On-site storage or sale of removed items or materials is not permitted.

1.06 SUBMITTALS

- A. Proposed Protection Measures: Submit informational report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- B. Adjacent Structures: Detail special measures proposed to protect adjacent structures to remain.
- C. Provide schedule of proposed selective demolition activities including: proposed start and end dates of each activity, interruption of utility services, coordination with the District's continued operations of adjacent facilities.
- D. Closeout submittal: Provide As-Built drawings indicating location, material and size of buried utilities, appurtenances, pipes, conduit and structures that were relocated, capped, abandoned in place, or otherwise left to remain on the site below grade.

1.07 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with the Peralta Community College District governing regulations before beginning demolition. Comply with hauling and disposal regulations of the City of Oakland.
- B. Standards: Comply with ANSI A10.6 – Safety and Health Program Requirements for Demolition Operations, and NFPA 241 – Standard for Safeguarding Construction, Alteration, and Demolition Operations.
- C. Hazardous Materials:

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1. It is not expected that hazardous materials will be encountered in the Work.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the District. Hazardous materials will be removed under a separate contract.

1.08 COORDINATION

- A. Arrange demolition schedule so as not to interfere with operations of adjacent occupied buildings and streets.
- B. Demolition activities shall be coordinated with the City of Oakland, the District and all pertinent utility companies prior to start of work.

1.09 EXPLOSIVES

- A. Explosives: Use of explosives is NOT permitted.

PART 2 - MATERIALS

2.01 CEMENT SLURRY

- A. For utilities to be abandoned, fill with slurry conforming to Caltrans 19-3.02E.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. The Contractor is responsible for field locating all existing conditions including underground utilities in the area of work, regardless of whether or not they are indicated on the plans or other record drawings.
- B. Should uncharted or incorrectly charted existing utilities be identified, Contractor shall contact the Engineer immediately for instructions. Provide a scale drawing with the location and any additional information discovered regarding the uncharted utility.
- C. Verify which utilities will need to be disconnected and capped before starting demolition operations.
- D. Verify what temporary electricity or other utilities will need be provided prior to start of demolition.
- E. Survey existing conditions and correlate with requirements indicated to determine and mark extent of selective demolition. Clearly mark items with the area that are to be protected in place.
- F. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- G. Document existing structures to remain that are damaged and submit photographs to Merritt College.
- H. Where existing conditions conflict with representations of the Contract Document, notify the and obtain clarifications. Do not perform work affecting the conflicting conditions until clarification of the conflict is received.

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- I. Refer to Section 02 41 19 – LANDSCAPE SELECTIVE DEMOLITION for items to be salvaged for the District's use.

3.02 PREPARATION

- A. Existing Utilities: Locate, identify, disconnect, and seal or cap off all utilities serving buildings and structures to be demolished unless otherwise indicated on the Plans.
1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Peralta Community College District and utility municipalities.
 2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures. Provide minimum 72-hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- B. Refer to Section 02 41 19 LANDSCAPE SELECTIVE DEMOLITION for requirements for irrigation systems.
- C. Verify that the area to be demolished has been vacated and/or adequate space is made available to perform the work.
- D. Mark cutting work and coordinate any work for which cutting is required.
- E. Refer to Section 01 56 39 – TEMPORARY TREE AND PLANT PROTECTION for protection of existing vegetation.

3.03 PROTECTION

- A. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from District and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by the City of Oakland.
- B. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- C. Existing Facilities to Remain: Protect adjacent site features including walkways, landscape to remain, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- D. Erect temporary protection, such as walks, fences, railings. Refer to Division 1 provisions.
- E. Trees and other landscaping to be protected in place: Clearly mark and place appropriate barricade around all trees and landscaping to be protected in place. Protection for trees to remain shall effectively prevent disturbance to the tree or surrounding soils for the full canopy area.
- F. The Contractor shall maintain all temporary barriers around open excavations or other hazardous conditions as long as the hazard exists. Remove temporary barriers and protections where hazards no longer exist.

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3.04 DEMOLITION OF EXISTING FACILITIES

- A. Contractor shall stake and relocate Project Coordinate Point prior to start of construction. Project Coordinate Point is located on civil plans. New location of project coordinate point shall be recorded and maintained throughout the entirety of the project. Project Coordinate Point Northing and Easting are located on civil Plans.
- B. Completely clear the site of all existing improvements, vegetation and surface treatments, as required to permit construction of proposed improvements within the limits shown on the plans.
- C. Where utility removal is shown on the plans, excavate to expose existing utility, remove section of pipe/conduit indicated. Cap section of pipe/conduit to remain. Mark capped end of utility with stake, rebar, or Surveyor's marker.
 - 1. Provide thrust block or mechanical restraints where dead end is created on pressurized pipe systems.
 - 2. Included in demolition are any appurtenances associated with the removed pipe.
 - 3. Backfill trench in accordance with requirements of Section 31 23 33 TRENCHING, BACKFILLING AND COMPACTING.
 - 4. Fill pipes to be abandoned with cement slurry.
- D. Below-Grade Construction:
 - 1. Abandon foundation walls and other construction located below the subgrade of proposed improvements. Cut below-grade construction approximately 2 feet below subgrade, unless specified otherwise on the Demolition Plans.
- E. Asphalt Pavement:
 - 1. Remove asphalt concrete pavement by saw cutting to the full depth of the pavement. Provide neat saw cuts at the limits of pavement removal as indicated on the drawings.
 - 2. Remove any base material, gravel, and/or any other non-native soil.
- F. Concrete Pavement, Walks and Curbs:
 - 1. Remove concrete pavement and walks to the nearest joint. Saw cut concrete if joints are not present adjacent to the area of demolition.
 - 2. Saw cut concrete along straight lines to a depth of not less than 2 inches. Break out remainder of concrete, provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through concrete.
- G. If known or suspected hazardous materials are encountered during operations, stop operations immediately and notify the District.
- H. If unknown items such as human remains are encountered, stop operations immediately and notify the District.

3.05 SITE RESTORATION

- A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Section 31 22 00 – EARTHWORK AND GRADING.
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes and deleterious materials. Provide a smooth transition between adjacent existing grades and new grades.
 - 1. Do not alter grade in the root zone of existing trees. Refer to Section 01 56 39 – TEMPORARY TREE AND PLANT PROTECTION.

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- C. Refer to Section 31 22 00 – EARTHWORK AND GRADING.

3.06 REPAIRS

- A. Promptly repair damage to adjacent buildings or facilities caused by demolition operations to match condition and appearance of adjacent undamaged work.

3.07 EXCAVATION

- A. All removed asphalt, concrete and miscellaneous materials will become the property of the Contractor. This includes excess excavation spoils (earth and aggregate base) not needed as fill.
- B. Refer to Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
- C. Remove demolition waste materials from Project site.
1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- D. Do not burn demolished materials.

3.08 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

3.09 FIELD QUALITY CONTROL

- A. The District will accompany the Contractor before and after performance of work to observe physical conditions of existing structures or improvements involved.

END OF SECTION

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(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
N&T 22003	Oakland, California

SECTION 02 41 16 - BUILDING DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Building demolition.
- B. Construction waste reduction, disposal, and recycling including required documentation for Construction Waste Management Plan and its implementation.
- C. Pollutant control measures.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 11 00 - Summary of Work: Limitations on Contractor's use of site and premises.
- C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers.
- D. Section 01 56 39 - Temporary Tree and Plant Protection.
- E. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- F. Section 01 81 13 - Sustainable Design Requirements: For pollutant control and indoor air quality management during selective demolition operations.
- G. Section 02 41 13 - Selective Site Demolition: Demolition and removal of existing site features including pavements, below-grade construction and utilities.
- H. Section 02 41 19 - Selective Demolition: Requirements for removal and protection of trees and plants; description of items to be salvaged or removed for re-use by Contractor.
- I. Section 31 00 00- Site Clearing.
- J. Section 31 25 00 - Erosion and Sedimentation Control.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2019.

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Issue for Bid		Building Demolition

(MLH)/Project No. 2463	Peralta Community College District
DSA #01-119409	Merritt College New Landscape Horticulture Complex
N&T 22003	Oakland, California

1.04 DEFINITIONS

- A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.
- B. Storage or sale of removed items or materials on-site is not permitted.
- C. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to the Owner's designated storage area.
- D. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.
- E. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, at the Contractor's option and at no additional cost, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.
- F. Materials Ownership: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

1.05 SUBMITTALS

- A. CALGreen submittals: Refer to Section 01 74 19 - Construction Waste Management and Disposal for planning and documentation of construction waste resulting from demolition activities.
 - 1. Construction Waste Management Plan: Prepare and submit in accordance with CALGreen requirements.
 - 2. Construction Waste Management Worksheets: Prepare and submit in accordance with CALGreen requirements.
 - 3. Construction Waste Management Acknowledgment: Prepare and submit in accordance with CALGreen requirements.
- B. Site Plan: Showing:
 - 1. Vegetation and site improvements to be protected.
 - 2. Areas for temporary construction and field offices.
 - 3. Areas for temporary and permanent placement of removed materials.

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C. Demolition Plan: .

1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.

D. Schedule of selective demolition activities indicating the following:

1. Interruption of utility services and security devices.
2. Coordination for shutoff, capping, and continuation of utility services and security devices.
3. Above items shall be shown on Preliminary schedule, Final Schedule, and 3-week look aheads. Final dates of shutdowns are required no less than 10 days prior to activity in a request to Owner's Representative in writing.

E. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.06 QUALITY ASSURANCE

- A. Pre-Demolition Meeting: Participate in Pre-Demolition Meeting specified in Section 02 41 19 - Landscape Selective Demolition

PART 2 PRODUCTS

2.01 MATERIALS

- A. NOT USED

PART 3 EXECUTION

SCOPE

3.01 HAZARDOUS MATERIALS

- A. The District has obtained and made available: "HAZARDOUS BUILDING MATERIAL SURVEY REPORT MERRITT COLLEGE – HORTICULTURE COMPLEX - OAKLAND, CALIFORNIA" dated November 19, 2020.

3.02 POLLUTANT CONTROLS

- A. Recycle and/or salvage for reuse non-hazardous demolition waste in accordance with requirements of Section 01 74 19 - Construction Waste Management and Disposal. Remove from site all materials not to be reused on site.

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- B. CALGreen Requirements: Refer to Section 01 81 13 - Sustainable Design Requirements for requirements for temporary ventilation and pollutant control.
- C. Utilize suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations and requirements of Section 01 50 00 - Temporary Facilities and Controls.
- D. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- E. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.
- F. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of demolition.
- G. Hazardous materials shall be remediated before proceeding with building demolition operations.

3.03 STRUCTURE DEMOLITION

- A. Remove existing buildings in their entirety as indicated in the Contract Documents.
- B. Remove decayed, vermin-infested, or otherwise deleterious or unsuitable materials and promptly dispose of off-site.
- C. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
- D. Remove paving and curbs as required to accomplish demolition work.
- E. Within area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.
- F. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations according to backfill requirements in Division 31.
- G. Remove fences and gates where indicated.
- H. Remove other items indicated, for salvage, relocation, and recycling.
 - 1. Store items to be salvaged and reinstalled in a secure and protected location until ready for reinstallation.

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3.04 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with requirements of the Contract including investigation, preparation, temporary facilities and documentation required by the Owner.
- B. Refer to the District's report "HAZARDOUS BUILDING MATERIAL SURVEY REPORT MERRITT COLLEGE – HORTICULTURE COMPLEX - OAKLAND, CALIFORNIA" dated November 19, 2020."
- C. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Do not burn demolished materials.
 - 5. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 6. Provide and maintain interior and exterior bracing or structural support to preserve stability and prevent movement, settlement, or collapse of portions of building during demolition activities.
 - 7. Strengthen or add new supports when required during progress of demolition.
- D. Provide, erect, and maintain temporary barriers and security devices.
 - 1. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
- E. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 1. Do not close or obstruct roadways or sidewalks without permit.
 - 2. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 3. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

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- F. Do not begin removal until Demolition Plan has been approved by the District and receipt of District's authorization to proceed with demolition operations.
- G. Do not begin removal until built elements to be salvaged or relocated have been removed.
- H. Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Owner, items may be removed to a suitable, protected storage location.
- I. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.
- J. Protect existing structures, site improvements, appurtenances, and landscaping to remain.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
- K. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- L. If hazardous materials are discovered during removal operations, stop work and notify Architect and District; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- M. Perform demolition in a manner that maximizes salvage and recycling of materials.
 - 1. Comply with requirements of Section 01 74 19 - Construction Waste Management and Disposal.
 - 2. Dismantle existing construction and separate materials.
 - 3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.
 - 4. Store items to be salvaged and reinstalled in a secure and protected location until ready for reinstallation.
- N. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.05 MANAGEMENT OF DEMOLISHED MATERIALS

- A. Recycle and/or salvage for reuse non-hazardous demolition waste in accordance with requirements of Section 01 74 19 - Construction Waste Management and Disposal. Remove from site all materials not to be reused on site. do not burn or bury.

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- B. Refer to the Division 01 for procedures to follow if materials containing asbestos or lead are encountered.

3.06 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations.
1. Return adjacent areas to condition existing before selective demolition operations began.
 2. Leave site in clean condition, ready for subsequent work.
- B. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

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SECTION 02 41 19 - LANDSCAPE SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected site elements, including but not limited to:
 - a. Bike racks
 - b. Miscellaneous fences and gates
 - c. Overhead and vertical trellises
 - d. Raised planting beds
 - e. Built-in wood seats
 - f. Landscape water features
 - g. Informal steps at overlook
 - 2. Removal of selected planting.
 - 3. Relocation of selected trees.
 - 4. Removal of selected irrigation equipment.
 - 5. Salvage of existing items for future use by Owner unless otherwise specified, including but not limited to:
 - a. Wood from raised beds, seats, trellises and other wood site elements.
 - b. 3 x 3 and 6 x 6 wood lumber
 - c. Wood logs and log seats
 - d. Irrigation valves and spray heads
 - e. Movable outdoor furniture
 - f. Chain link gates
 - g. Terracotta and galvanized steel planter pots
 - 6. Salvage of existing items for use and installation in project landscape improvements:
 - a. Boulders, to be reused on site by Contractor
 - b. Miscellaneous wood lumber salvaged from raised beds and seats for reuse by Contractor for construction of raised vegetable beds.
 - c. 1 x and 4 x wood posts salvaged from miscellaneous site structures for reuse in signage and wayfinding applications.
 - d. Rain water barrels for reuse by Contractor on site.
- B. Related Requirements:

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1. Section 01 56 39 - Temporary Tree and Plant Protection, for temporary protection of existing trees and plants that are affected by selective demolition.
2. Section 01 73 29 - Cutting and Patching, for cutting and patching procedures.
3. Section 01 74 19 - Construction Waste Management and Disposal
4. Section 02 41 13 – Selective Site Demolition, for regulatory agencies and coordination of demolition and removal or abandoning of existing site features.
5. Section 31 00 00 - Site Clearing, for site clearing and removal of above- and below-grade improvements not part of Landscape Selective Demolition.
6. Section 32 96 00 – Transplanting, for plants to be relocated within the site

1.03 DEFINITIONS

- A. Abandon: Detach from all connecting structures or pipelines and leave in place, below grade only. In the case of utility lines, cap or otherwise plug all connections with lines to remain in service, and fill or plug the section(s) to be abandoned in accordance with these specifications.
- B. Demolish: Completely remove and legally dispose of off-site.
- C. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- D. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- E. Dismantle: Remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- F. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- G. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled. Protect from damage from construction operations.
- H. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- I. Salvage: Recovery of demolition or construction waste for subsequent sale or reuse in another facility. The Contractor shall take all reasonable measures to protect elements for salvage from damage during removal, storage and transport. Store salvaged items at location approved by Landscape Architect.
- J. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work. Contractor shall take all reasonable measures to protect elements for salvage from damage during removal, storage and transport.

1.04 VALUABLE ITEMS AND STRUCTURES

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- A. Protect from damage valuable structures, including, but not limited to:
 - 1. Japanese-style wood gate
 - a. Under the supervision of Owner's Representative, carefully dismantle Japanese-style wood gate. Provide documentation of existing condition and assembly of gate.
 - 2. Outdoor kitchen stand
 - 3. Wood platform
 - 4. Wood overlook deck
 - 5. Stacked retaining walls
 - 6. Patio paving
- B. Protect from damage valuable items, including but not limited to:
 - 1. Miscellaneous site 6x6 lumber
 - 2. Miscellaneous wood 1x and 4x posts
 - 3. Site boulders
 - 4. Planter pots
 - 5. Compost bins
 - 6. Rain water barrels
- C. Store salvaged items on site in locations as directed by Landscape Architect.
- D. Re-used items on site:
 - 1. Refer to Landscape Drawings for new permanent locations and installation of boulders and compost bins.
 - 2. Refer to Civil and Architectural Drawings for permanent locations and installation of rain water barrels.
 - 3. Refer to Wayfinding Drawings for information for reuse of wood posts.

1.05 PRE-DEMOLITION MEETINGS

- A. Pre-demolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review demolition plans and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 4. Review areas where existing construction is to remain and requires protection.
 - 5. Refer Section 01 56 39 – Temporary Tree and Plant Protection.

1.06 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Refer to Section 02 41 13 – Selective Site Demolition.
- B. Schedule of Selective Demolition Activities: Refer to Section 02 41 13 – Selective Site Demolition.

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- C. Documentation of existing site conditions which establishes pre-construction conditions that might be misconstrued as damage caused by construction activities.
 - 1. Use sufficiently detailed photographs or video recordings. Provide a minimum of one overall photo and two close-up photos of each valuable structure to remain.
 - 2. Provide no less than twelve photographs of existing Japanese-style wood gate showing overall structure, each side, roof, posts, method of construction, and footings. Document existing condition for wear and damages prior to dismantling, and submit to Landscape Architect for record.
 - 3. Mark all documentation with date indicating when photographs or videos were taken.

1.07 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Landscape Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Storage or sale of removed items or materials on-site is not permitted.
- D. Storage on site of items to be reused or relocated is allowed.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped in accordance with Section 02 41 13 – Selective Site Demolition before starting demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

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- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, seal or cap off irrigation systems serving areas to be demolished.
 - 1. If irrigation systems serving existing plants to remain both within and outside of contract scope are removed, relocated, or abandoned, provide temporary systems that bypass area of selective demolition and that maintain continuity of services to other parts of the site.

3.03 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent structures and facilities to remain. Refer to Section 02 41 13 "Selective Site Demolition" for additional requirements.
- B. Refer to section 01 56 39 "Temporary Tree and Plant Protection" for additional requirements.

3.04 SELECTIVE LANDSCAPE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective landscape demolition systematically.
 - 2. Neatly cut surfaces for openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing, grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 3. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 74 19 "Construction Waste Management and Disposal."
- B. Site Access and Temporary Controls: Conduct landscape selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Neatly stack, pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until pickup by Owner or otherwise directed by Landscape Architect.
 - 4. Protect items from damage during storage.
 - 5. Clean and repair items to functional condition adequate for intended reuse.
 - 6. 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.

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- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition.

3.05 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces.
 3. Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.06 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing prior demolition operations.

END OF SECTION

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SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Form-facing material for cast-in-place concrete.
2. Shoring, bracing, and anchoring.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1.03 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Exposed surface form-facing material.
2. Concealed surface form-facing material.
3. Form ties.
4. Waterstops.
5. Form-release agent.

B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.

1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.
 - a. Location of construction joints is subject to approval of the Architect.
3. Indicate location of waterstops.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

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PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 - 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 - 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

2.02 FORM-FACING MATERIALS

- A. As-Cast Surface Form-Facing Material:
 - 1. Provide continuous, true, and smooth concrete surfaces.
 - 2. Furnish in largest practicable sizes to minimize number of joints.
 - 3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete", and as follows:
 - a. FSC plywood material.
 - b. Exterior-grade FSC plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) APA HDO (high-density overlay).
 - 2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
 - 3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
 - 4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.
- B. Concealed Surface Form-Facing Material: FSC lumber, FSC plywood.
 - 1. Provide lumber dressed on at least two edges and one side for tight fit.

2.03 WATERSTOPS

- A. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.

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2.04 RELATED MATERIALS

- A. Reglets: Fabricate reglets of not less than 0.022-inch thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- C. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 - 2. Form release agent for form liners shall be acceptable to form liner manufacturer.
- D. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

PART 3 - EXECUTION

3.01 INSTALLATION OF FORMWORK

- A. Comply with ACI 301.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete" for as-cast finishes.
- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.

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- F. Do not use rust-stained, steel form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips.
 - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
- I. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
- J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- K. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 3. Place joints perpendicular to main reinforcement.
 - a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and curbs at the top of footings or floor slabs per drawings.
- L. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
 - 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 - 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

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- M. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- N. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- O. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 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 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.
 - 4. Clean embedded items immediately prior to concrete placement.

3.03 INSTALLATION OF WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm.
 - 1. Install in longest lengths practicable.
 - 2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
 - 3. Allow clearance between waterstop and reinforcing steel of not less than 2 times the largest concrete aggregate size specified in Section 03 30 00 "Cast-In-Place Concrete."
 - 4. Secure waterstops in correct position at 12 inches on center.
 - 5. Field fabricate joints in accordance with manufacturer's instructions using heat welding.
 - a. Miter corners, intersections, and directional changes in waterstops.
 - b. Align center bulbs.
 - 6. Clean waterstops immediately prior to placement of concrete.
 - 7. Support and protect exposed waterstops during progress of the Work.

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B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, according to manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.

1. Install in longest lengths practicable.
2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
3. Protect exposed waterstops during progress of the Work.

3.04 FIELD QUALITY CONTROL

A. Inspections:

1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.

END OF SECTION

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SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Steel reinforcement bars.
 2. Welded-wire reinforcement.

1.02 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

- A. Product Data: For the following:
1. Each type of steel reinforcement.
 2. Bar supports.
 3. Mechanical splice couplers.
- B. Shop Drawings: Comply with ACI SP-066:
1. Include placing drawings that detail fabrication, bending, and placement.
 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
- C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
1. Location of construction joints is subject to approval of the Architect.

1.04 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
1. Reinforcement to Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M
- B. Material Test Reports: For the following, from a qualified testing agency:

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1. Steel Reinforcement:
 - a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
2. Mechanical splice couplers.
- C. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

PART 2 - PRODUCTS

2.01 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 or Grade 80, deformed, as noted in drawings.
- B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Headed-Steel Reinforcing Bars: ASTM A970/A970M.

2.02 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
- B. Mechanical Splice Couplers: ACI 318 Type 2, same material of reinforcing bar being spliced; tension-compression type.
- C. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.

2.03 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

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PART 3 - EXECUTION

3.01 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.02 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
 - 2. Stagger splices in accordance with ACI 318.
 - 3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
 - 4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

3.03 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

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1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.04 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.05 FIELD QUALITY CONTROL

- A. Special Inspections: District will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
 1. Steel-reinforcement placement.
 2. Steel-reinforcement mechanical splice couplers.
 3. Steel-reinforcement welding.

END OF SECTION

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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, vapor retarder, and finishes.
- B. Related Requirements:
 - 1. Section 03 10 00 "Concrete Forming and Accessories" for form-facing materials, form liners, and waterstops.
 - 2. Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
 - 3. Section 03 35 44 "Polished Concrete Finishing"
 - 4. Section 32 13 13 "Concrete Paving"
 - 5. Section 07 13 00 "Sheet Waterproofing"

1.02 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

- A. Mockup: Provide a minimum of a 48 inch by 48 inch mockup panel for review of light broom swirl finish pattern and depth of broom work.
- B. Product Data: For each of the following.
 - 1. Portland cement.
 - 2. Fly ash.
 - 3. Slag cement.
 - 4. Aggregates.

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5. Admixtures:
 - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
 6. Vapor retarders.
 7. Liquid floor treatments.
 8. Curing materials.
 9. Joint fillers.
- C. Design Mixtures: For each concrete mixture, include the following:
1. Mixture identification.
 2. Minimum 28-day compressive strength.
 3. Durability exposure class.
 4. Maximum w/cm.
 5. Calculated equilibrium unit weight, for lightweight concrete.
 6. Slump limit.
 7. Air content.
 8. Nominal maximum aggregate size.
 9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
 10. Intended placement method.
 11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- D. Shop Drawings:
1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Architect.
- E. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:
1. Concrete Class designation.

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2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.05 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each of the following, signed by manufacturers:
 1. Cementitious materials.
 2. Admixtures.
 3. Curing compounds.
 4. Vapor retarders.
 5. Joint-filler strips.
- B. Material Test Reports: For the following, from a qualified testing agency:
 1. Portland cement.
 2. Fly ash.
 3. Slag cement.
 4. Aggregates.
 5. Admixtures:
- C. Research Reports: For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
- D. Preconstruction Test Reports: For each mix design.
- E. Field quality-control reports.

1.06 QUALITY ASSURANCE

- A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

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1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.07 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
 1. Include the following information in each test report:
 - a. Admixture dosage rates.
 - b. Slump.
 - c. Air content.
 - d. Seven-day compressive strength.
 - e. 28-day compressive strength.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94/C94M and ACI 301.

1.09 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.02 CONCRETE MATERIALS

- A. Cementitious Materials:
 1. Portland Cement: ASTM C150/C150M, Type I or Type II.
 2. Fly Ash: ASTM C618, Class C or F.
 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C33/C33M, Class 1N coarse aggregate or better, graded. Provide aggregates from a single source.
 1. Alkali-Silica Reaction: Comply with one of the following:

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- a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
 - c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
2. Maximum Coarse-Aggregate Size: 1 inch nominal.
 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Air-Entraining Admixture: ASTM C260/C260M.
- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 2. Retarding Admixture: ASTM C494/C494M, Type B.
 3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
- E. Water and Water Used to Make Ice: ASTM C94/C94M, potable and complying with ASTM C1602/C1602M, including all limits listed in Table 2 and the requirements of paragraph 5.4.

2.03 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.04 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

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2.05 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
 - 1. Color:
 - a. Ambient Temperature Below 50 deg F: Black.
 - b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
 - c. Ambient Temperature Above 85 deg F: White.
- C. Curing Paper: Eight-feet wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.
- D. Water: Potable or complying with ASTM C1602/C1602M.
- E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.
- F. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B.
- G. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.06 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
- B. Floor Slab Protective Covering: Eight-feet wide cellulose fabric.

2.07 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
 - 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Total of Fly Ash or Other Pozzolans: Varies by Class, 50% maximum.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

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1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete and concrete with a w/cm below 0.50.

2.08 CONCRETE MIXTURES

- A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.
 1. Exposure Class: ACI 318 S0.
 2. Minimum Compressive Strength: 4000 psi at 28 days.
 3. Maximum w/cm: 0.50.
- B. Class B: Normal-weight concrete used for building walls/curbs.
 1. Exposure Class: ACI 318 C0.
 2. Minimum Compressive Strength: 4000 psi at 28 days.
 3. Maximum w/cm: 0.50.
- C. Class D: Normal-weight concrete used for interior slabs-on-ground and polished floors.
 1. Exposure Class: ACI 318 C0.
 2. Minimum Compressive Strength: 4000 psi at 28 days.
 3. Maximum w/cm: 0.43.
 4. Air Content:
 - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
 5. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.
 6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

2.09 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.

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- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
 2. For mixer capacity larger than 1 cu. yd, increase mixing time by 15 seconds for each additional 1 cu. yd.
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.01 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, shelf angles, and other conditions.

3.02 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
 2. Face laps away from exposed direction of concrete pour.
 3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
 4. Lap joints 6 inches and seal with manufacturer's recommended tape.
 5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
 6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.

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7. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.03 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
 3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
 1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
 1. Install dowel bars and support assemblies at joints where indicated on Drawings.
 2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

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F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.04 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
 - 1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 - 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
 - 1. If a section cannot be placed continuously, provide construction joints as indicated.
 - 2. Deposit concrete to avoid segregation.
 - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.

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- d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Do not place concrete floors and slabs in a checkerboard sequence.
 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 3. Maintain reinforcement in position on chairs during concrete placement.
 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 5. Level concrete, cut high areas, and fill low areas.
 6. Slope surfaces uniformly to drains where required.
 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 8. Do not further disturb slab surfaces before starting finishing operations.

3.05 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
 - b. Remove projections larger than 1 inch.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 Class D.
 - e. Apply to concrete surfaces not exposed to public view.
2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
 - b. Remove projections larger than 1/4 inch.
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 Class B.

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e. Locations: Apply to concrete surfaces exposed to public view.

B. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.06 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces. Reference Section 03 35 44 "Polished Concrete Finish".

B. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish to be covered with fluid-applied or sheet waterproofing, flooring (epoxy floor coating), or sand-bed terrazzo.

C. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view to be covered with resilient flooring, and epoxy set over a cleavage membrane.
7. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed

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anywhere on the surface does not exceed 1/4 inch and also no more than 1/16 inch in 2 feet.

- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.
 - 1. Coordinate required final finish with Architect before application.
 - 2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Light Broom Finish, Swirl Pattern: Apply a light broom finish and swirl pattern to exposed floor slabs indicated on Drawings.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by light brooming with fiber-bristle broom perpendicular to main traffic route.
 - 2. At floors designated on drawings to receive light broom finish, provide light swirl pattern as approved in mockup.
- F. Medium Broom Finish, Fine-Line Texture: Apply a medium broom finish and fine-line texture pattern to locations indicated on Drawings and Division 32.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by medium brooming with fiber-bristle broom perpendicular to main traffic route.
 - 2. At floors designated on drawings to receive medium broom finish, provide fine-line texture pattern as approved in mockup.

3.07 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

- A. Filling In:
 - 1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
 - 2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
 - 3. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - 2. Construct concrete bases 6 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions

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of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.

3. Minimum Compressive Strength: 4000 psi at 28 days.
4. 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.
5. For supported equipment, install anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.08 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
 2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
 3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305.1, before and during finishing operations.
- B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:
 1. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
 2. If forms remain during curing period, moist cure after loosening forms.
 3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.

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- c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
- d. Water-Retention Sheetting Materials: Cover exposed concrete surfaces with sheetting material, taping, or lapping seams.
- e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

- 1. Begin curing immediately after finishing concrete.
- 2. Interior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12-inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.

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- b. Floors to Receive Penetrating Liquid Floor Treatments: This applies to all exposed concrete floors. Contractor has option of the following:
- 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- c. Floors to Receive Polished Finish: Contractor has option of the following:
- 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- d. Floors to Receive Epoxy Flooring:

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- 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - 2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
 - 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
 - 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.
- e. Floors to Receive Curing Compound:
- 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Maintain continuity of coating, and repair damage during curing period.
 - 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
- f. Floors to Receive Curing and Sealing Compound:
- 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.09 TOLERANCES

- A. Conform to ACI 117.

3.10 APPLICATION OF LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.
1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than three days old.

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3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
 4. Rinse with water; remove excess material until surface is dry.
 5. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.11 FIELD QUALITY CONTROL

- A. Special Inspections: District will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: District will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
 2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
 - a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.

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- 9) Truck and batch ticket numbers.
- 10) Design compressive strength at 28 days.
- 11) Concrete mixture designation, proportions, and materials.
- 12) Field test results.
- 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
- 14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Plant Inspections: Provide continuous inspection unless all requirements of CBC 1705A.3.3.1 are satisfied:

1. 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 enforcement agency. The certification shall indicate that the plant has automatic batching and recording capabilities.
2. An approved agency 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 quantity of materials and certify each load by a batch ticket.
4. Batch Tickets, including material quantities and weights shall accompany the load, shall be transmitted to the inspector of record by the truck driver with load identified thereon. The load shall not be placed without a batch ticket identifying the mix. The inspector of record shall keep a daily record of placement, identifying each truck, its load, and time of receipt at the jobsite, and approximate location of deposit in the structure and shall maintain a copy of the daily record as required by the enforcement agency.

D. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.

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- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C143/C143M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete:
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure two sets of four 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
 - b. Cast, initial cure, and field cure four standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one set of four laboratory-cured specimens at seven days and one set of two specimens at 28 days.
 - b. Test one set of four field-cured specimens at seven days and one set of two specimens at 28 days.
 - c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

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7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
 9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 10. Additional Tests:
 - a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301, section 1.6.6.3.
 11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 72 hours of completion of floor finishing and promptly report test results to Architect.

3.12 PROTECTION

- A. Protect concrete surfaces as follows:
1. Protect from petroleum stains.
 2. Diaper hydraulic equipment used over concrete surfaces.
 3. Prohibit vehicles from interior concrete slabs.
 4. Prohibit use of pipe-cutting machinery over concrete surfaces.
 5. Prohibit placement of steel items on concrete surfaces.

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6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION

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SECTION 03 35 45 - POLISHED CONCRETE FINISHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Special Provisions, and other Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Refinishing concrete slabs-on-grade by cleaning, application of liquid surface treatment and diamond polishing concrete using multi-step wet/dry mechanical process and accessories indicated to achieve specified finish and appearance level.

1.03 SUSTAINABILITY REQUIREMENTS

- A. Refer to Section 01 81 13 for sustainability requirements related to this Section

1.04 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical data sheets and installation instructions for each product specified including the following:
 - 1. Liquid surface treatment.
 - 2. Floor polish.
 - 3. Joint sealant.
- B. Samples for Initial Selection: Manufacturer's color charts showing full range of stain colors available.
- C. CALGreen Submittals: Provide product data for the following:
 - 1. For CALGreen 5.504.4.3 – Finish Material Pollutant Control, Paints and Coatings: Product data and material safety data sheets (MSDS) for coatings, including printed statement of chemical composition and VOC content of each product used.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For firms indicated in "Quality Assurance" Article, including lists of completed projects with project names and addresses, names and addresses of architects, owners, and other information specified.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data:

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1. Include manufacturer's instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.07 QUALITY ASSURANCE

- A. Mockups: Before finishing existing and new concrete floors, build mockups to verify selections made under sample submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of fabrication and installation. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 1. Build mockups of 100 square feet in size in a room scheduled for carpet tile directly adjacent to area to be polished as directed by Architect.
 2. Build mockups of typical concrete slab area including polishing and joints.
 3. Demonstrate preparation, cleaning, and protecting of concrete, finishes, cracks, and contraction joints, as applicable.
 4. Produce mock up with the same workers who will polish the concrete.
 5. In presence of Architect, damage part of the exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of damage and surface blemishes to match adjacent undamaged surfaces.
 6. Obtain Architect's approval of mockups before proceeding with finishing existing concrete floors.
- B. Sample may be placed as part of the final construction of the project, but must be removed and replaced if rejected as a sample. Sample will serve as the standard for the balance of the work and shall be protected against damage until final approval of the entire installation.
- C. Polisher Qualifications:
 1. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
 2. Supervision: Maintain competent supervisor who is at Project during times specified work is in progress, and is currently certified as Craftsman or Master Craftsman by CPAA.

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3. Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.
- D. Static Coefficient of Friction: Achieve not less than 0.5 for level floor surfaces as determined by quality control testing according to ANSI/NFSI B101.1.
- E. Liquid Surface Treatment Applicator Qualifications:
 1. Provide letter of certification from manufacturer stating that the applicator is an approved applicator of the product system, is in good standing, and is familiar with the proper manufacturer's procedures and installation requirements.
 2. Provide a list of a minimum of 5 projects performed of similar type, size and complexity.
- F. Ensure slab surface is protected from equipment scrapes, impact abrasions, etc.
- G. Source Limitations: Obtain each specified material from one source and from a single manufacturer.

1.08 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Prior to initiating concrete floor polishing operations, conduct conference at Project site.
 1. Required Attendees:
 - a. Owner.
 - b. Architect.
 - c. Project Inspector.
 - d. Contractor, including supervisor.
 - e. Concrete finisher and his foreman.
 - f. Concrete polisher and his foreman.
 - g. Technical representative of liquid applied product manufacturers.
 2. Determine at what stage in construction floors are to be finished.
 3. Review patching requirements and relationship to polishing operations for existing floor penetrations.
 4. Review procedures, materials, techniques, and coordinate related work and shutdowns.

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- a. Tour mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
- b. Review Contract Document requirements.
- c. Review approved submittals.
- d. Review procedures, including, but not limited to:
 - 1) Details of each step of grinding, honing, and polishing operations.
 - 2) Application of liquid applied products and stage in the polishing operations they should be applied.
 - 3) Protecting concrete floor surfaces until polishing work begins.
 - 4) Protecting polished concrete floors after polishing work is completed.
- B. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Deliver the specified products in original, unopened containers with legible manufacturer's identification and information.
- B. Store specified products in conditions recommended by the manufacturer.
- C. Deliver materials in manufacturer's original containers, with seals unbroken, bearing manufacturer's labels indicating brand name, batch/lot numbers and directions for storage.
- D. Dispense special concrete finish materials from factory numbered and sealed containers. Maintain record of batch/lot numbers.
- E. Submit record of batch/lot numbers to liquid surface treatment manufacturer for validation and issuance of warranties at the conclusion of the applications.

1.10 SITE CONDITIONS

- A. Coordinate the work so as not to delay other work in progress.
- B. Maintain the immediate work areas clear of other trades, pedestrian traffic and disturbances immediately prior to and during polishing operations.

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- C. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces to be polished.
 - 1. Inspect and Diaper all hydraulic powered equipment to avoid staining of the concrete.
 - a. Ensure vehicles and equipment used on slabs have tires that will not leave marks.
 - 2. Prohibit vehicle parking over concrete surfaces to be polished.
 - a. If necessary to complete their scope of work, place drop cloths under vehicles at all times.
 - 3. Prohibit pipe cutting and threading operations over concrete surfaces to be polished.
 - 4. Prohibit ferrous metals storage over concrete surfaces to be polished.
 - 5. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces to be polished.
 - 6. Protect from acids and acidic detergents contacting concrete surfaces to be polished.
 - 7. Protect from painting activities over concrete surfaces to be polished.
- D. Close areas to traffic during polishing operations and, after completion of polishing, for time period recommended in writing by manufacturer.
- E. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.
 - 1. Dispose of used or diluted liquid surface treatment chemicals and wash water according to applicable Governmental standards.
- F. Protection: Precautions shall be taken to avoid damage or contamination of any surfaces near the work zone. Protect completed stain work from moisture or contamination.

PART 1 PRODUCTS

2.01 SUSTAINABLE PRODUCT REQUIREMENTS, GENERAL

- A. VOC Content: Coatings applied on-site on the interior of the building and products used on the interior of the building shall comply with VOC limits as specified in Section 01 81 13 - Sustainable Design Requirements.
 - 1. Use materials that have the minimum VOC content in units of g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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2.02 MANUFACTURERS

- A. Basis-of-Design Product: The design for the floor polishing system is based on the manufacturer identified below. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
1. Basis-of-Design: L & M Construction Chemicals.
 2. Nox Crete.
 3. Consolideck by PROSOCO, Inc.

2.03 EQUIPMENT

- A. Field Grinding and Polishing Equipment:
1. Variable speed, machine with planetary/counter rotating concrete grinding heads, walk-behind machine with not less than 600 pounds of down pressure on grinding or diamond polishing pads.
 2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.
 3. Areas over 6,000 square feet are considered large projects and machines with a 32 inch grinding area are recommended. Smaller project recommend a heavy 21 inch or comparable planetary/counter rotating head machine.
- B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field grinding and polishing equipment.
- C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.
- D. Metal Bonded Pads: Grinding pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.
- E. Resin Bonded Pads: Polishing pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.
- F. Burnishing Pads: Maintenance pads for use with high speed burnishing equipment.

2.04 POLISHING MATERIALS

- A. Liquid Densifier: Odorless, non-hazardous, silicate that penetrates concrete to react with free lime and calcium hydroxide to produce permanent chemical reaction that hardens and

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densifies concrete surface.

1. Use materials that have maximum VOC content of 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Grout Material: Clear modified silicate sealant, containing no pore clogging latex, when mixed with dust salvaged from grinding process forms a paste that reacts with calcium hydroxide in concrete that hardens when surface imperfections are filled.
- C. Polish Guard: Non-film forming, stain resistant, food resistant, chemical stain resistant, impregnating sealant designed to be used on concrete surfaces previously densified.
- D. Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.
- E. Water: Potable.

2.05 JOINT SEALANT

- A. Self leveling, 100% solids, two component, 1:1 ratio, polyurea joint filler.
 1. HiTech HT-PE75 MI or similar product; compatible with polishing system and intended for floors with light to moderate traffic, Product shall rapidly dry tack free and ready to be shaved and opened to traffic in less than an hour.

PART 1 EXECUTION

3.01 EXAMINATION, GENERAL

- A. Verification of Conditions: Examine areas and conditions under which work will be performed and identify conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected
- B. Remove coatings, water repellents, previously applied adhesives, and curing membranes by sandblasting; small spots of paint may be removed with a scraper and a commercial paint stripper.
- C. Do not use acid washing as a cleaning procedure.

3.02 EXAMINATION FOR POLISHING

- A. Acceptance of Surfaces and Conditions:
 1. Examine substrates to be polished for compliance with requirements and other conditions affecting performance.

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2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.03 PREPARATION FOR POLISHING

- A. Correct cracks and abrupt changes in surface profile. Remove fins and projections.
- B. Remove all curing compounds and sealers.
- C. Examine slab surface prior to starting work, with liquid surface treatment applicator present, for any conditions affecting the Applicator's ability to properly apply the liquid surface treatment. Do not proceed until unsatisfactory conditions are corrected.
- D. Prior to application, verify that floor surfaces are free of laitance.
- E. Do not allow vehicular traffic on the slab.
- F. Report in writing surfaces left in improper condition by other trades.
- G. Commencement of finishing procedures will constitute applicators acceptance of conditions.

3.04 POLISHING

- A. Sequence of Polishing: Perform polishing after partition studs are erected, but before gypsum board is installed.
- B. Examination and Preparation:
 1. Immediately prior to starting work, verify that surfaces conform to product manufacturer's requirements for substrate conditions.
 2. Vacuum and clean saw cut joints and surrounding area so that no dust remains to react with liquid surface treatment material.
 3. Prior to application, verify floor is free of latent salts, curing membrane, bond- breaker, laitance and any other residues that are detrimental to achieving surface appearance requirements.
 4. Beginning of liquid surface treatment application indicates acceptance of existing conditions.
- C. Treating Surface Imperfections:

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1. Mix patching compound and grout material with dust created by grinding operations to match color of adjacent concrete surface.
2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids.
3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

D. Liquid Densifier Application:

1. Apply products to substrates in accordance with manufacturer's instructions, and application procedures.
2. Apply to clean, dry, and properly prepared surfaces approved by the Architect.
3. Do not dilute or alter product. Apply as packaged.
4. Do not apply to painted surfaces.
5. Allow applied material to remain on the surface for reaction for time period recommended by manufacture. If the material puddles on surface, move applied material around with a micro fiber pad to achieve uniform coverage. Do not apply additional material.
6. Allow applied material on surface to dry, approximately 30 to 60 minutes before polishing to next level. If white residue appears on surface after drying, material will be removed with additional polishing steps.

E. Comply with flooring system manufacturer's recommendations and instructions regarding preparation and mixing of materials and application of each component of floor finishing system.

1. Employ methods to ensure concrete surface is not damaged during application, including discoloration.
2. Apply liquid surface treatment in accordance with latest manufacturer's published instructions.
3. Whitening of concrete by over-application or inadequate removal of liquid surface treatment may be cause for rejection.

F. Grout Grinding:

1. Use grinding equipment and appropriate grit grinding pads.

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2. While applying fresh grout material prior to, grind concrete in direction perpendicular to initial grinding to remove scratches.
3. Vacuum floor using squeegee vacuum attachment after each pass.

G. Honing:

1. Use grinding equipment with resin bonded grinding pads.
2. Grind concrete in one direction starting with 50 grit pad and make as many sequential passes required to remove scratches, each pass perpendicular to previous pass, up to 400 grit pad reaching maximum refinement with each pass before proceeding to finer grit pads.
3. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.

H. Polishing:

1. Use polishing equipment with resin bonded polishing and burnishing pads.
2. Begin polishing in one direction starting with 60 grit pad.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 800 grit.
4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.
6. Continue polishing until gloss appearance, as measured according to ASTM E430, matches approved field mock-ups.
7. Ensure that there are no visible "disc marks" on polished concrete finished floor.

I. Polish Guard: Uniformly apply and remove excessive liquid according to manufacturer's instructions.

J. Final Polish: Using burnishing equipment and finest grit burnishing pads, burnish to uniform sheen matching approved mock-up.

K. Final Polished Concrete Floor Finish:

1. Class B – Fine Aggregate (Salt and Pepper) Finish: Remove not more than 1/16 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying fine aggregate with no, or small amount of, medium aggregate at random locations.

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2. Level 2 – Medium Gloss Appearance:

- a. Procedure: Not less than 5 step process with full refinement of each diamond pad up to 800 grit resin bonded pad with one application of densifier.
- b. Gloss Reading: Not less than 55 according to ASTM E430 before polish guard application.
- L. Joint Sealant: Fill all floor joints with specified sealant. Shave and repair any surface damage at joints.

3.05 FIELD QUALITY CONTROL

- A. Field Testing: Owner will engage a qualified walkway auditor to perform field testing according to ANSI/NFSI B101.1 to determine if polished concrete floor finish complies with specified static coefficient of friction.

3.06 CLEANING

- A. Construction Waste Management: Manage construction waste in accordance with provisions of Section 017419 Construction Waste Management and Disposal.
- B. Covering: After completion of polishing, protect polished floors from subsequent construction activities with protective covering.

3.07 DEMONSTRATION

- A. Maintenance Training: CPAA Master Craftsman shall train Owner's designated personnel in proper procedures for maintaining polished concrete floor.

3.08 PROTECTION

- A. Restrict foot traffic for a minimum of 72-hours after final application of sealer.
- B. Do not permit marking of the finished floor, even with pencil. Do not apply chemicals of any kind.
- C. Do not permit spills of any kind from coming in contact with finished floors as they will be impossible to remove without damaging the finish.
- D. Leave finished work and work area in a neat, broom-clean condition without evidence of spillovers onto adjacent areas.
- E. Follow all protection requirements specified in Quality Assurance Article.

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F. Architect and Owner will review protection procedures to approve their adequacy.

END OF SECTION

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SECTION 04 22 00 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units.
 - 2. Decorative concrete masonry units.
 - 3. Steel reinforcing bars.

1.02 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For reinforcing steel. Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
- C. Samples: For each type and color of the following:
 - 1. Exposed CMUs.

1.04 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of product. For masonry units, include data on material properties and material test reports substantiating compliance with requirements.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
 - 2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

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1.05 QUALITY ASSURANCE

- A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01 40 00 "Quality Requirements" for mockups.
 - 1. Build sample panels for each type of exposed unit masonry construction, typical exterior and interior walls in sizes approximately 48 inches long by 48 inches high by full thickness.

1.06 FIELD CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.01 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.02 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated. Concrete Masonry Units, color to match color of decorative concrete masonry units, precision surface. Decorative Concrete Masonry Units color to be selected from full manufacturer's color ranges, combed face finish at all exterior surfaces.

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1. Provide special shapes for top caps, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.
- C. CMUs: ASTM C90.
 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
 2. Density Classification: Normal weight.

2.03 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C91/C91M.
- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
- F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 1. Colored Portland Cement-Lime Mix:
 2. Colored Masonry Cement:
- G. Aggregate for Mortar: ASTM C144.
 1. White-Mortar Aggregates: Natural white sand or crushed white stone.
 2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- H. Aggregate for Grout: ASTM C404.

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- I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
- K. Water: Potable.

2.04 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
- C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
 - 1. Interior Walls: Mill galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized carbon steel.
 - 3. Wire Size for Side Rods: 0.148-inch diameter.
 - 4. Wire Size for Cross Rods: 0.148-inch diameter.
 - 5. Spacing of Cross Rods: Not more than 16 inches o.c.
 - 6. Provide in lengths of not less than 10 feet with prefabricated corner and tee units.

2.05 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
 - 2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
 - 3. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

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- B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch diameter, hot-dip galvanized-steel wire.
 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch diameter, hot-dip galvanized-steel wire.
- C. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch thick steel sheet, galvanized after fabrication.
 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch diameter, hot-dip galvanized-steel wire.
- D. Partition Top Anchors: 0.105-inch thick metal plate with a 3/8-inch diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.

2.06 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
 2. Copper: ASTM B370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick or ASTM B370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight or 0.0162 inch thick.
 3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 4. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.

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5. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
 6. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
- B. Flexible Flashing: Use one of the following unless otherwise indicated:
1. Copper-Laminated Flashing: 5-oz./sq. ft copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 2. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch.
 3. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.030 inch.
 4. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymers alloy.
 5. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M, 0.040 inch thick.
- C. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. Cell flashing pans have integral weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar.
- D. Solder and Sealants for Sheet Metal Flashings: As specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
- E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.07 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

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- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.08 MASONRY-CELL FILL

- A. Lightweight-Aggregate Fill: ASTM C331/C331M.

2.09 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
- Do not use calcium chloride in mortar or grout.
 - Use portland cement-lime or masonry cement mortar unless otherwise indicated.
 - For exterior masonry, use portland cement-lime or masonry cement mortar.
 - For reinforced masonry, use portland cement-lime or masonry cement mortar.
 - Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification with 28-day compressive strength not less than 1800 psi. Provide the following types of mortar for applications stated unless another type is indicated.
- For all masonry, use Type S.
- D. Pigmented Mortar: Use colored cement product.
- Pigments shall not exceed 10 percent of portland cement by weight.
 - Pigments shall not exceed 5 percent of masonry cement by weight.
 - Application: Use pigmented mortar for exposed mortar joints with the following units:
 - Decorative CMUs.
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

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1. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:

- a. Decorative CMUs.

F. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.02 TOLERANCES

- A. Dimensions and Locations of Elements:
 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.

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2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.03 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- F. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

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3.04 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.05 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

3.06 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
 - 1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.

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2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.07 FLASHING

- A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.
- B. Install flashing as follows unless otherwise indicated:
 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
 3. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

3.08 REINFORCED UNIT MASONRY

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

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- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches.

3.09 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.
- E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.
- F. Mortar Test Property Specification: For each mix provided, according to ASTM C780. Test mortar for mortar air content and compressive strength.
- G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.
- H. Prism Test: For each type of construction provided, according to ASTM C1314 at seven days and at 28 days.

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3.10 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.11 REPAIRING, POINTING, AND CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
 - 2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.12 MASONRY WASTE DISPOSAL

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

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SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Shear stud connectors, shop welded.
 - 3. Shrinkage-resistant grout.

1.02 RELATED SECTIONS

- A. Section 01 81 13 "Sustainable Design Requirements"
- B. Section 03 30 00 "Cast-In-Place Concrete"
- C. Section 03 32 00 "Concrete Reinforcing"
- D. Section 05 50 00 "Metal Fabrications"
- E. Section 09 90 00 "Painting"

1.03 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.05 ACTION SUBMITTALS

- A. Product Data:
 - 1. Structural-steel materials.
 - 2. High-strength, bolt-nut-washer assemblies.
 - 3. Shear stud connectors.
 - 4. Anchor rods.
 - 5. Threaded rods.

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6. Forged-steel hardware.
7. Shop primer.
8. Galvanized-steel primer.
9. Etching cleaner.
10. Galvanized repair paint.
11. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1.06 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Mill test reports for structural-steel materials, including chemical and physical properties.
- C. Source quality-control reports.
- D. Field quality-control reports.

1.07 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector.
- C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
 1. ANSI/AISC 303.
 2. ANSI/AISC 360.
 3. AISC 341.

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4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:

1. Connection designs have been completed and connections indicated on the Drawings.

C. Moment Connections: Type FR, fully restrained.

D. Construction: Special cantilever column system.

2.02 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M, Grade 50.

B. Channels, Angles: ASTM A36/A36M, ASTM A572/A572M, Grade 50.

C. Plate and Bar: ASTM A36/A36M, ASTM A572/A572M, Grade 50.

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.03 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with plain finish.

B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490, Type 1, heavy-hex steel structural bolts or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 490-1, compressible-washer type with plain finish.

C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip or mechanically deposited zinc coating.

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2. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with mechanically deposited zinc coating finish.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex round head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 1. Finish: Mechanically deposited zinc coating.
- E. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.04 RODS

- A. Unheaded Anchor Rods: ASTM F1554, Grade 36, Grade 55, Grade 105.
 1. Configuration: Straight, Hooked.
 2. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.
- B. Headed Anchor Rods: ASTM F1554, Grade 36, Grade 55, Grade 105, straight.
 1. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.
- C. Threaded Rods: ASTM F1554, Grade 36, Grade 55, Grade 105, straight.
 1. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

2.05 FORGED-STEEL STRUCTURAL HARDWARE

- A. Clevises and Turnbuckles: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1035.

2.06 PRIMER

- A. Steel Primer:
 1. Comply with Section 09 90 00 "Painting".
 2. Interior: SSPC-Paint 23, latex primer.
 3. Exterior: Comply with Section 09 90 00 "Painting."
 4. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer and compatible with topcoat.

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- B. Galvanized-Steel Primer: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
1. Tnemec L69
 2. Devoe Tru Glaze WB4030
- C. Etching Cleaner: For galvanized steel. Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
1. Cloverdale Paint, "ClovaClean."
 2. Rust-Oleum, "Krud Kutter."
 3. Sherwin-Williams, "Clean'n Etch."
- D. Galvanizing Repair Paint: SSPC-Paint 20, ASTM A780/A780M.

2.07 FILLER

- A. Polyester filler intended for use in repairing dents in automobile bodies.

2.08 SHRINKAGE-RESISTANT GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.09 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
- B. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.
- C. Exposed Welds: Where welds and connections are exposed to view in the final structure, comply with the following.
1. 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.

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5. Limit butt and plug weld projections to 1/16 inch.
6. Remove weld spatter, slivers, and similar surface discontinuities.
7. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
8. Grind tack welds smooth unless incorporated into final welds.
9. Remove backing and runoff tabs, and grind welds smooth.

2.10 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Snug tightened, Pretensioned, Slip critical.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
- C. Exposed Connections:
 1. Grind all welds smooth where they will be exposed to view in the finished building.

2.11 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M; refer to drawings for indication of what items are to be galvanized and which are to be painted, or galvanized and painted.
 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

2.12 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 2. Surfaces to be field welded.
 3. Surfaces of high-strength bolted, slip-critical connections.
 4. Galvanized surfaces, unless indicated to be painted.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

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1. SSPC-SP 2.
 2. SSPC-SP 6 (WAB)/NACE WAB-3 at exposed members.
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner.
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
- E. Wrap all shop-primed steel that will be exposed for protection prior to transportation to the site.

2.13 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
 2. Bolted Connections: Inspect and test shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - b. Ultrasonic Inspection: ASTM E164.
 - c. Radiographic Inspection: ASTM E94/E94M.
 4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M.
 5. Prepare test and inspection reports.

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PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Weld plate washers to top of baseplate.
 3. Pretension anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

3.03 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
 1. Joint Type: Snug tightened, Pretensioned, Slip critical.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

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3.04 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
 - 1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
 - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 2) Ultrasonic Inspection: ASTM E164.
 - 3) Radiographic Inspection: ASTM E94/E94M.

END OF SECTION

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SECTION 05 50 00 - METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel and aluminum items.
- B. Downspout guards.
- C. Metal fences and frames.
- D. Gates and gate hardware.
- E. Framing accessories.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- C. Section 05 12 00 - Structural Steel Framing: Structural steel framing and anchor bolts.
- D. Section 05 50 10 - Landscape Metal Fabrications: Shop-fabricated steel for exterior benches, trellises and landscape elements.
- E. Section 05 52 13 - Pipe and Tube Railings.
- F. Section 06 20 00 - Finish Carpentry: Wood infill for fences and gates.
- G. Section 07 13 00 - Sheet Waterproofing: PMMA flashing at steel column and post bases.
- H. Section 08 71 00 - Door Hardware: Lock cylinders, padlocks, and miscellaneous hardware as indicated.
- I. Section 08 80 00 - Glazing: Polycarbonate infill panels for gates and screens as indicated.
- J. Section 09 90 00 - Painting: Field-applied paint finishes.
- K. Section 12 36 00 - Countertops: Solid surface and stainless steel countertops

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

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- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.
- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- I. ASTM A1011/A1011M - 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 2018a.
- J. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes 2019a.
- K. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2019.
- L. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- M. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- N. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- O. ASTM F3125/F3125M - 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 2019, with Editorial Revision (2020).
- P. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.
- Q. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.

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- R. AWS D1.2/D1.2M - Structural Welding Code - Aluminum 2014, with Errata.
- S. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).
- T. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).
- U. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.04 SUBMITTALS

- A. CALGreen Submittals: Provide the following:
 - 1. Product Data for CALGreen 5.504.4.3 – Finish Material Pollutant Control; Architectural paints and coatings, including printed statement of VOC content and chemical components.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths and weld locations.
- C. Provide templates for anchors and bolts specified for installation under other Sections.
- D. Where concrete inserts are required, show size and locations required.
- E. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

- A. Design Criteria
 - 1. Work shall be designed to support normally imposed loads and conform to AISC requirements.
 - 2. Built-up parts shall not exhibit warp
- B. Welding Standards: Comply with applicable provisions of AWS D1.1 and AWS D1.3.
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

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PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- H. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- I. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- J. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- K. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction, including CALGreen.
- L. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction, including CALGreen.

2.02 MATERIALS - ALUMINUM

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.
- D. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.
- E. Bolts, Nuts, and Washers: Stainless steel.
- F. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.03 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.

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- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

- A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
- B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of countertops, and similar non-structural items; prime paint finish.
- C. Miscellaneous Framing Accessories:
 - 1. Pre-assembled engineered pony wall support stud and baseplate for support of cantilevered pony wall framing.
 - a. Manufacturer: Clark Dietrich Pony Wall Series
 - b. Plate Material: ASTM A36 1/2" thick hot rolled steel
 - c. Stud Material: Structural Grade 50 Type H (ST50H), 50ksi 12 gauge, 0.0966" minimum thickness
 - d. Heights and anchorage as indicated on drawings.
 - 1) PW24 = 23-3/4" tall with 3-3/8" wide x 8" long plate
 - 2) PW36 = 35-3/4" tall with 3-3/8" wide x 8" long plate
 - 3) PW48 = 47-3/4" tall with 3-3/8" wide x 8" long plate
- D. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.
- E. Downspout Guards: Omega Industries or equivalent 3/16 inch thick bent galvanized steel plate; 36 inch length; galvanized and clear coated finish. Profile and attachment as shown

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on drawings. <https://www.omegaindl.com>.

2.05 METAL FENCES, GATES, AND FRAMES:

- A. Tubular frame, welded construction, galvanized, unpainted.
- B. Fabricate metal fences and gates in accordance with drawing details.
- C. Wood Infill Panels: Provide in accordance with drawing details and requirements of Section 06 20 00 - Finish Carpentry
- D. Metal Infill Panels: Nominal 1 3/4 inch deep galvanized steel louver intended for visual screening.
 - 1. Manufacturers:
 - a. Basis of Design: Ametco Shadow 80 Electro-forged welded steel fencing. 1-31/32" x 1/16" formed main bar, 5/32" round cross bar. Galvanized to ASTM 123. Approximate weight 2.84 pounds per squarefoot. <https://www.ametco.com/panel-types/shadow-80/>
 - b. Marco Steel Orsogril Talialive
 - c. Metalco "Grigliato"
- E. Stainless Steel Welded Wire Mesh Panel:
 - 1. 2-3/4" opening
 - 2. 0.250" wire
 - 3. 84.0% open space
- F. Sliding Panel Hardware: Hangers, roller assemblies, and stops fabricated from galvanized steel.
- G. Size track, track supports, trucks, and rollers to support size, weight, width, operation, and design of door and roller assemblies, as indicated on the Drawings.
- H. Verify keying requirements with the District. Provide 6 keys.

2.06 GATE HARDWARE

- A. Hardware Group 20 - Swinging Pair Gate Hardware List; clear zinc finish:
 - 1. Hinges: Crown Industrial CBI 8505 full-surface; non-metallic self-lubricating bearing; designed for door weights up to 800 pounds and exterior applications. Provide top,

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bottom, and intermediate hinge for each gate leaf. Provide hinges punched for installation with three 1/2 inch diameter hex head bolts per hinge leaf.

2. Bow Pull: Provide two pulls per swinging panel. Crown Industrial 81P2 eight inch long malleable iron pull for attachment with four self-tapping screws. Powder coat finish metallic gray. Mount one pull to interior and exterior face of leading rail as shown on details.
3. Cane Bolts: Crown Industrial 524P21; includes hold-up spring assembly and padlock shackle. Provide one cane bolt and two strikes for each gate leaf.
4. Single Cylinder Deadbolt and Cylinder: Refer to Section Section 08 71 00 - Door Hardware. Provide with strike for double gate application.

B. Hardware Group 21 - Swinging Single Gate Hardware List; clear zinc finish:

1. Hinges: Crown Industrial CBI 8505 full-surface; non-metallic self-lubricating bearing; designed for door weights up to 800 pounds and exterior applications. Provide top, bottom, and intermediate hinge for each gate leaf. Provide hinges punched for installation with three 1/2 inch diameter hex head bolts per hinge leaf..
2. Bow Pull: Provide two pulls per swinging panel. Crown Industrial 81P2 eight inch long malleable iron pull for attachment with four self-tapping screws. Powder coat finish metallic gray. Mount one pull to interior and exterior face of leading rail as shown on details.
3. Cane Bolts: Crown Industrial 524P21; includes hold-up spring assembly and padlock shackle. Provide one cane bolt and two strikes for each gate leaf.
4. Single Cylinder Deadbolt and Cylinder: Refer to Section Section 08 71 00 - Door Hardware. Provide with strike for single gate application.

C. Hardware Group 22 - Barn Door Hardware List; clear zinc finish:

1. Overhead Track Assembly: Crown Industrial 43T 1/4 inch x 2 inch flat track with 1/2 inch I.D. wall spacers fasteners and accessories
2. Flat Track Hangers: Crown Industrial 43HO steel wheel roller flat track hanger assembly; 400 lb capacity; 2 per panel.
3. Floor-Mounted Guide Rollers: Crown Industrial heavy duty steel guide roller assembly; 2 per panel.
4. Track Stop: Crown Industrial 43S field-adjustable stop; 2 per panel.
5. Anti-Jump Block: Crown Industrial ; 2 per panel.

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6. Padlock Hasp: Knifeplate welded to gate panel frame and jamb frame.
7. Bow Pull: Provide two pulls per sliding panel. Crown Industrial 81P2 eight inch long malleable iron pull for attachment with four self-tapping screws. Powder coat finish metallic gray. Mount one pull to interior and exterior face of leading rail as shown on details.
8. Padlock: Refer to Section 08 71 00 - Door Hardware

D. Hardware Group 23 - Sliding Gate Hardware List; clear zinc finish:

1. Overhead Track Assembly: Crown Industrial #4 box track with overhead framing supports, bracing, fasteners and accessories; 2 tracks per pair of panels for bypassing installation.
2. Bottom Guide: Galvanized steel angle as indicated; 2 guides per pair of panels for bypassing installation.
3. Top Trucks: Crown Industrial 4Z2R heavy duty adjustable steel wheel roller bearing hanger assembly; 400 lb capacity; 2 per panel.
4. Bottom Rollers: Crown Industrial CR6 heavy duty steel wheel roller assembly; 2 per panel.
5. Track Stop: Crown Industrial CR313-CTS concealed field-adjustable stop; 2 per track.
6. Locking Cane Bolt: Crown Industrial 524P21; includes hold-up spring assembly and padlock shackle.
7. Padlock Hasp: Knifeplate welded to gate panel frame and jamb frame. 1 per panel.
8. Bow Pull: Provide two pulls per sliding panel. Crown Industrial 81P2 eight inch long malleable iron pull for attachment with four self-tapping screws. Powder coat finish metallic gray. Mount one pull to each face of leading rail as shown on details.
9. Padlocks: Refer to Section 08 71 00 - Door Hardware

2.07 FINISHES - STEEL

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for requirements for low-emitting materials, Architectural Paints and Coatings including aerosol paint and coating systems.
- B. Prime paint steel items.
 1. All interior exposed steel to be primed with products compatible with interior finish systems specified in Section 09 90 00 - Painting.

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2. All exterior exposed steel to be primed with products compatible with high performance coating specified in Section 09 90 00 - Painting.
3. Exceptions:
 - a. Do not prime surfaces in direct contact with concrete, or where field welding is required.
 - b. Do not prime fences and gates and other items indicated to be exposed galvanized finish.
- C. Prepare surfaces to be primed in accordance with SSPC-SP2.
- D. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- E. Prime Painting: One coat.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.08 FINISHES - ALUMINUM

- A. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system; color as indicated.
 1. Manufacturers:
 - a. Valspar; Fluropon: www.valsparcoilextrusion.com/#sle.
- B. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.09 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on drawings. Grind all welds smooth.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

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SECTION 05 50 10 – LANDSCAPE METAL FABRICATIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Shop fabricated steel items for overhead wood trellises.
- B. Shop fabricated attachments for festival lights.
- C. Shop fabricated steel brackets and supports for built-in wood benches, wood caps and seats with storage.
- D. Shop fabricated steel brackets and miscellaneous metal items for raised vegetable beds.

1.03 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete, for placement of metal fabrications in concrete.
- B. Section 04 20 00 - Unit Masonry, for placement of metal fabrications in masonry.
- C. Section 05 52 13 – Pipe and Tube Railings, for handrails at stairs.
- D. Section 06 10 63 – Exterior Rough Carpentry, for trellises, built-in seats and benches.
- E. Section 09 90 00 – Painting, for steel finishes.
- F. Section 32 14 00 – Unit Paving, for adjacent unit paving.

1.04 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2018.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2014 (Editorial 2017).

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- G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2018.
- H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2014.
- I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.
- J. ASTM A1011/A1011M - 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 2018a.
- K. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions 2015a.
- L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.
- M. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).
- N. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel 2017.
- O. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).
- P. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," Type II, "Organic") 2002 (Ed. 2004).
- Q. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.05 SUBMITTALS

- A. Product Data: Refer to Division 1.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include plans, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.
- E. Samples: For each paint color to be applied, 6-inch by 6-inch swatch. Refer to Section 09 90 00 "Painting."

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.

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- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- F. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by intermittent welds and plastic filler.
- D. Shop weld all connections prior to delivery of fabricated items to site.
- E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

2.04 FINISHES - STEEL

- A. Galvanizing: Shop hot-dip galvanize all exterior steel after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.
- B. Prime paint all exterior steel items.
 - 1. Exceptions: Galvanized items to be embedded in concrete, items to be embedded in concrete or masonry.
 - 2. Exceptions: Do not prime surfaces in direct contact with concrete or where field welding is required.
 - 3. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- C. Prepare surfaces to be primed in accordance with SSPC-SP2.

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- D. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- E. Paint all exposed steel finishes. Refer to Section 09 90 00 "Painting" for exterior applications.
 - 1. Prime Painting: One coat.
 - 2. Finish Painting: Two coats.
 - a. Color: TBD.

2.05 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. All exterior steel to be shop welded.
 - 1. Where field spot welding is required, clean and strip primed steel items to bare metal.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. After installation, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- C. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
 - 1. Obtain approval prior to site cutting or making adjustments not scheduled.
- D. Fit exposed connections accurately together to form hairline joints. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

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- E. Welding: Comply with the following requirements:
 - 1. Perform field welding in accordance with AWS D1.1/D1.1M.
 - 2. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 3. Obtain fusion without undercut or overlap.
 - 4. Remove welding flux immediately.
 - 5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface
- F. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- G. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.04 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.05 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

3.06 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00 – Painting.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.
- D. Raw Surfaces: Clean surfaces, welds, all connections and abraded areas. Do not scratch surfaces.

END OF SECTION

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SECTION 05 52 13 – PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Galvanized steel tube handrails at stairs.
- B. Related Requirements:
 - 1. Section 03 30 00 – Cast-in-Place Concrete, for stairs and post footings.
 - 2. Section 32 14 00 – Unit Paving, for adjacent surfacing.

1.03 COORDINATION

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Schedule installation so wall or curb attachments are made only to completed walls and curbs. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.04 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Railing brackets.
 - 3. Grout and anchoring cement.
 - 4. Epoxy.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. All drawings to be to scale and dimensioned.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.

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- B. Welding certificates.
- C. Mill Certificates: Signed by manufacturers of steel products certifying that products furnished comply with requirements.
- D. Product Test Reports: For tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
- E. Evaluation Reports: For post-installed anchors from ICC-ES.

1.06 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following: 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.08 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, curbs and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Tube Railings: Contractor's choice.
 - 1. See Drawings for sizes.
- B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Railings, including attachment to walls and curbs, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Railings:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

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1. Temperature Change: 120 deg F, ambient; 180 deg F material surfaces.

2.03 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.04 STEEL

- A. Tubing: ASTM A 513.
- B. Plate and Sheet: ASTM A 53/A 53M Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 1. Provide hot-dip galvanized for exterior installations.

2.05 FASTENERS

- A. General: Provide the following:
 1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

2.06 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 1. For galvanized steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint20.

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- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
 - 1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.07 STEEL FINISHES

- A. Galvanized Handrails:
 - 1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
 - a. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - b. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
 - 2. Provide hot-dip galvanized fittings, brackets, fasteners, sleeves and other ferrous components.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.02 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

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- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 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 flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Form Changes in Direction by radius bends of radius indicated on drawings.
- J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- K. Close exposed ends of railing members with prefabricated end fittings.
- L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
- M. For railing posts set in concrete, provide galvanized steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

3.03 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.04 RAILING CONNECTIONS

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- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.05 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

3.06 ADJUSTING AND CLEANING

- A. Clean steel by washing thoroughly with clean water and soap and rinsing with clean water.

3.07 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

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SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Shear wall panels.
4. Rooftop equipment bases and support curbs.
5. Wood blocking and nailers.
6. Wood furring.
7. Wood sleepers.
8. Plywood backing panels.
9. Wood treatments.

1.02 RELATED SECTIONS

- A.** Section 01 81 13 "Sustainable Design Requirements".
- B.** Section 06 10 63 "Exterior Rough Carpentry: Trellises, Benches and Similar Landscape Elements".

1.03 ACTION SUBMITTALS

- A.** Product Data: For each type of process and factory-fabricated product.
- B.** Sustainable Design Submittals:
1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 2. Chain-of-Custody Qualification Data: For manufacturer and vendor.
 3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
 4. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.

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5. Product Data: For installation adhesives, indicating VOC content.

1.04 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
1. Wood-preserved-treated wood.
 2. Fire-retardant-treated wood.
 3. Engineered wood products.
 4. Shear panels.
 5. Power-driven fasteners.
 6. Post-installed anchors.
 7. Metal framing anchors.

1.05 QUALITY ASSURANCE

- A. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

- A. Certified Wood: Certify the following wood products as "FSC Pure" in accordance with FSC STD-01-001 and FSC STD-40-004.
1. Dimension lumber.
 2. Laminated-veneer lumber.
 3. Parallel-strand lumber.
 4. Laminated-strand lumber.
 5. Prefabricated wood I-joists.

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- B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Dress lumber, S4S, unless otherwise indicated.
- C. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.
- D. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.02 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing. Wood sleepers installed with roof insulation, and wood sleepers in roof assembly.
 - 2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.

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3. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
 1. Concealed blocking.
 2. Roof construction.
 3. Plywood backing panels.

2.04 DIMENSION LUMBER FRAMING

- A. Stud Walls, Partitions, Plates and Blocking in walls: No. 2 grade.
 1. Application: All stud framed wall elements.
 2. Species:
 - a. Douglas fir-larch; WCLIB.

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B. Framing Other Than Walls and Partitions: No. 1 grade.

1. Application: Joists, posts, beams, and all other framing not located in a stud wall.
2. Species:
 - a. Douglas fir-larch; WCLIB.

C. Exposed Framing: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Species and Grade: As indicated above for load-bearing construction of same type; no pine species are acceptable for this exposed framing.

2.05 ENGINEERED WOOD PRODUCTS

- A. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde resins, as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products," or are made with no added formaldehyde.
- B. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.
- C. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.
 1. Extreme Fiber Stress in Bending, Edgewise: 2600 psi for 12-inch nominal-depth members.
 2. Modulus of Elasticity, Edgewise: 2,000,000 psi.
- D. Wood I-Joists: Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Comply with material requirements of and with structural capacities established and monitored according to ASTM D5055.
 1. Web Material: Either OSB or plywood, complying with DOC PS 1 or DOC PS 2, Exposure 1.
 2. Structural Properties: Depths and design values not less than those indicated.

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3. Comply with APA PRI-400. Factory mark I-joists with APA-EWS trademark indicating nominal joist depth, joist class, span ratings, mill identification, and compliance with APA-EWS standard.
- E. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research or evaluation report for I-joists.
1. Manufacturer: Provide products by same manufacturer as I-joists.
 2. Material: Product made from any combination solid lumber, wood strands, and veneers.
 3. Thickness: Per plan.
 4. Comply with APA PRR-401, rim board grade. Factory mark rim boards with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.
- F. Insulated Rim Boards: Insulated product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.
1. Manufacturer: Provide products by same manufacturer as I-joists.
 2. Rim Board Material: Product made from any combination solid lumber, wood strands, and veneers.
 3. Rim Board Thickness: Per plan.
 4. Insulation: 1-1/2-inch-thick polyisocyanurate foam complying with ASTM C1289.
 5. Inside Facing: 7/16-inch-thick OSB.
 6. Comply with APA PRR-401, rim board grade. Factory mark rim boards with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.

2.06 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
 2. Nailers.
 3. Rooftop equipment bases and support curbs.
 4. Cants.

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5. Furring.
 6. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species, except no pine for exposed lumber.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
1. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

2.07 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Fire-Retardant-Treated Plywood, DOC PS 1, Exposure 1, C-D Plugged in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.08 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or Type 304 stainless steel.
- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on applicable ICC ESR as appropriate for the substrate.

2.09 METAL FRAMING ANCHORS

- A. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
1. Use for interior locations unless otherwise indicated.

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- C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.10 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- D. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
1. Verify adhesives have a VOC content of 70 g/L or less.
 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

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- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. ICC-ES evaluation report for fastener.

3.02 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

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SECTION 06 10 63 – EXTERIOR ROUGH CARPENTRY FOR LANDSCAPE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Provide all labor, materials, equipment, and services necessary to accomplish the following:
 - 1. Raised vegetable beds
 - 2. Overhead trellises
 - 3. Wood benches
 - 4. Wood caps at low CMU walls
 - 5. Stacked wood seat walls
 - 6. Wood seats with storage
 - 7. Wood header
 - 8. Wood lumber edging

1.03 RELATED REQUIREMENTS

- A. Section 01 18 13 – Sustainable Design Requirements
- B. Section 01 56 39 – Temporary Tree and Plant Protection, for protection of existing plants.
- C. Section 02 41 19 – Landscape Selective Demolition, for reuse of salvaged wood.
- D. Section 03 30 00 – Cast-In-Place Concrete, for concrete footings and anchors.
- E. Section 05 50 10 – Landscape Metal Fabrication, for metal fabricated items.
- F. Section 05 50 00 – Metal Fabrications, for miscellaneous steel connectors and supports for wood framing.
- G. Section 06 10 00 – Rough Carpentry, for framing, sheathing, and general building structure.
- H. Section 09 93 00 – Staining and Transparent Finishing, for wood finishes.
- I. Section 32 14 00 – Unit Paving, for adjacent surfacing.
- J. Section 32 15 41 – Aggregate Paving with Admixture, for adjacent paving.
- K. Division 26 – Electrical, for electrical connections to overhead trellis lights.

1.04 REFERENCE STANDARDS

- A. AF&PA WCD1 – Details for Conventional Wood Frame Construction.

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- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.
- D. CBC – California Building Code.
- E. PS 20 - American Softwood Lumber Standard 2015.
- F. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17 2015.
- G. WWP A G-5 - Western Lumber Grading Rules 2017.

1.05 SUBMITTALS

- A. Product Data: Provide technical data on all wood materials and application instructions.
- B. FSC certification per Section 01 18 13 – Sustainable Design Requirements.
- C. California Department of Forestry and Fire Protection WUI (Wildland Urban Interface) certification for Thermally Modified wood.
- D. Samples: For rough carpentry members that will be exposed to view, submit two samples, 4 by 4 inch min. in size illustrating wood grain, color, and general appearance.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

1.07 WARRANTY

- A. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide redwood graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - 3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified. Landscape Architect to approve substitutions prior to fabrication.

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- B. Lumber fabricated from old growth timber is not permitted.
- C. Provide sustainably harvested wood, see Section 01 18 13 – Sustainable Design Requirements.
- D. Lumber salvaged from deconstruction or demolition of existing wood seats, trellises or other landscape structures is permitted in lieu of sustainably harvested lumber provided it is clean, de-nailed, and free of paint and finish materials, and other contamination.
 - 1. Identify source.
 - 2. Salvaged wood shall be approved by Landscape Architect for re-use.
 - 3. Use for construction of raised vegetable beds only.

2.02 EXPOSED BOARDS

- A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.
- B. Sizes: Nominal sizes as indicated on Drawings.
- C. Moisture Content: Typical for thermally modified wood, 4-7%.
- D. Surfacing: S4S.
- E. Species: See Drawings.
- F. Grade: Construction.

2.03 FASTENERS

- A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate no less than 1-1/2 inches into wood substrate.
- B. Use fasteners with hot-dip zinc coating complying with ASTM A 153 or ASTM F 2329.
- C. Nails: ASTM F 1667
- D. Power-Driven Fasteners: ICC-ES AC70.
- E. Wood Screws and Lag Screws: ASME B 18.2.1
- F. Stainless Steel Bolts: ASTM 593, Alloy Group 1 or 2; with ASTM F 594, Alloy Group 1 or 2 hex nuts and flat washers.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and scope as needed for accurate fit.

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- B. Framing Standard: Comply with AF&PA WCD1 unless otherwise indicated.
- C. Install metal framing anchors to comply with manufacturer's written instructions.
- D. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- E. Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. ICC-ES AC70 for power-driven fasteners.
 - 2. Current California Building Code
- F. Use common wire nails unless otherwise indicated. Select fasteners of size that do not fully penetrate members where opposite side is exposed to view. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads unless otherwise indicated.

END OF SECTION

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SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Wall sheathing.
 - 2. Roof sheathing.
 - 3. Sheathing joint and penetration treatment.

1.02 RELATED SECTIONS

- A. Section 01 81 13 "Sustainable Design Requirements"
- B. Section 06 10 00 "Rough Carpentry"

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
- B. Sustainable Design Submittals:
 - 1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 - 2. Chain-of-Custody Qualification Data: For manufacturer and vendor.

1.04 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated plywood.
 - 2. Fire-retardant-treated plywood.

1.05 QUALITY ASSURANCE

- A. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

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PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.02 WOOD PANEL PRODUCTS

- A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Certified Wood: Certify the following wood products as "FSC Pure" in accordance with FSC STD-01-001 and FSC STD-40-004.
 - 1. Plywood.
 - 2. Oriented strand board.
 - 3. Particleboard underlayment.
 - 4. Hardboard underlayment.

2.03 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings.

2.04 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

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- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated in Section "06 10 00" Rough Carpentry.

2.05 WALL SHEATHING

- A. Plywood Sheathing: Exposure 1, Structural I sheathing.

2.06 ROOF SHEATHING

- A. Plywood Sheathing: Exposure 1, Structural I sheathing.

2.07 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or Type 304 stainless steel.

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2.08 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 and ASTM D3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code and 2019 CBC.
 - 2. ICC-ES evaluation report for fastener.
- D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.02 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall and Roof Sheathing:
 - a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
 - b. Space panels 1/8 inch apart at edges and ends.

END OF SECTION

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SECTION 06 18 00 - GLUED-LAMINATED CONSTRUCTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Framing using structural glued-laminated timber.

1.02 RELATED SECTIONS

A. Section 01 81 13 "Sustainable Design Requirements".

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
2. Chain-of-Custody Qualification Data: For manufacturer and vendor.

1.04 INFORMATIONAL SUBMITTALS

A. Certificates of Conformance: Issued by a qualified testing and inspecting agency indicating that structural glued-laminated timber complies with requirements in AITC A190.1.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: An AITC- or APA-EWS-licensed firm.

B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.

C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.06 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with provisions in AITC 111.

B. Individually wrap members using plastic-coated paper covering with water-resistant seams.

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PART 2 - PRODUCTS

2.01 STRUCTURAL GLUED-LAMINATED TIMBER

- A. General: Provide structural glued-laminated timber that complies with AITC A190.1 and AITC 117 or research/evaluation reports acceptable to authorities having jurisdiction.
 - 1. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that are not exposed in the completed Work.
 - 2. Provide structural glued-laminated timber made with wet-use adhesive complying with AITC A190.1.
- B. Certified Wood: Certify wood products as "FSC Pure" in accordance with FSC STD-01-001 and FSC STD-40-004.
- C. Species and Grades for Structural Glued-Laminated Timber: Douglas fir-larch that complies with structural properties indicated.
- D. Species and Grades for Beams:
 - 1. Species and Beam Stress Classification: Douglas fir-larch, 24F-V4 DF/DF typical and 24F-V8 DF/DF for cantilever or continuous applications.
 - 2. Lay-up: Balanced.
- E. Species and Grades for Columns and Truss Members:
 - 1. Species and Combination Symbol: Douglas fir-larch, 1.
- F. Appearance Grade: Premium, complying with AITC 110.

2.02 TIMBER CONNECTORS

- A. Materials: Unless otherwise indicated, fabricate from the following materials:
 - 1. Structural-steel shapes, plates, and flat bars complying with ASTM A36/A36M.
 - 2. Round steel bars complying with ASTM A575, Grade M 1020.
 - 3. Hot-rolled steel sheet complying with ASTM A1011/A1011M, Structural Steel, Type SS, Grade 33.
- B. Finish steel assemblies and fasteners with rust-inhibitive primer, 2-mil dry film thickness.

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- C. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A123/A123M or ASTM A153/A153M.

2.03 MISCELLANEOUS MATERIALS

- A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
- B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

2.04 FABRICATION

- A. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes.
- B. Camber: Fabricate horizontal and inclined members of less than 1:1 slope with either circular or parabolic camber equal to 1/500 of span.
- C. End-Cut Sealing: Immediately after end cutting each member to final length, apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood coated for not less than 10 minutes.
- D. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Erect structural glued-laminated timber true and plumb and with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
1. Handle and temporarily support glued-laminated timber to prevent surface damage, compression, and other effects that might interfere with indicated finish.
- B. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.

3.02 ADJUSTING

- A. Repair damaged surfaces after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by Architect.

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3.03 PROTECTION

- A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose, including protection from weather, sunlight, soiling, and damage from work of other trades.
 - 1. Slit underside of wrapping to prevent accumulation of moisture inside the wrapping.

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SECTION 06 20 00 - FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior Finish Carpentry
- B. Wood casings and moldings.
- C. Plywood wainscot.
- D. Plywood backboard for telecommunications equipment.
- E. Wood paneling with slatwall inserts.
- F. Wood infill for fences and gates.
- G. Removed and re-installed wooden cabinets.
- H. Removed and re-installed wood-block countertops.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 81 13 - Sustainable Design Requirements: Requirements for certified wood and low-emitting materials.
- C. Section 05 50 00 - Metal Fabrications: Metal framing for fences and gates.
- D. Section 06 10 00 - Rough Carpentry: Framing.
- E. Section 06 10 63 - Exterior rough Carpentry: Carpentry for landscape and site improvements.
- F. Section 06 41 00 - Architectural Wood Casework : Shop fabricated custom cabinet work.
- G. Section 07 46 49 - Poly-Ash Siding and Trim: Exterior siding and trim.
- H. Section 08 14 16 - Flush Wood Doors.
- I. Section 09 90 00 - Painting: Field finishing of finish carpentry work not indicated .to be shop finished.
- J. Section 10 26 00 - Wall Protection: Stainless steel corner guards and end caps.

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K. Section 12 35 53.19 - Wood Laboratory Casework.

1.03 REFERENCE STANDARDS

- A. APA PRP-108 - Performance Standards and Qualification Policy for Wood Structural Panels (Form E445) 2021.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 4.0 2021.
- E. PS 1 - Structural Plywood 2009 (Revised 2019).
- F. WI (CCP) - Certified Compliance Program (CCP) Current Edition.
- G. WI (CSIP) - Certified Seismic Installation Program (CSIP) Current Edition.

1.04 SUBMITTALS

- A. CALGreen Submittals: Provide the following:
 - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
 - 2. Product Data for CALGreen 5.504.4.5 – Composite Wood Products: For composite-wood products, showing requirements for formaldehyde as specified in Table 5.504.4.
 - 3. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for certified wood and low-emitting materials.
- B. Product Data:
 - 1. Provide instructions for attachment hardware and finish hardware.
- C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
 - 2. Include certification program label.

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- D. Samples: Submit two samples of finish plywood, 12 x 12 inch in size illustrating wood grain and specified finish.
- E. Samples: Submit two samples of wood trim 12 inch long.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.05 QUALITY ASSURANCE

- A. Forest Stewardship Council (FSC) Certified Products:
 - 1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
 - 2. Forest Certification: Provide components made with not less than 50 percent of wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- C. Quality Certification:
 - 1. Comply with WI (CCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section
www.woodworkinstitute.com/#sle.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
- B. Protect from moisture damage.
- C. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

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- B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.
- C. Interior Woodwork Items:
 - 1. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine or poplar; prepare for paint finish.

2.02 WOOD-BASED COMPONENTS

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for requirements for low-emitting materials, Composite Wood Products.
- B. Wood fabricated from timber recovered from riverbeds or otherwise abandoned is permitted, unless indicated otherwise, and provided it is clean and free of contamination, identify source; provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc. (ALSC).

2.03 LUMBER MATERIALS - INTERIOR

- A. Softwood Lumber: Clear white pine or poplar, smooth sawn, maximum moisture content of 6 percent, custom grade, of quality suitable for paint finish.
 - 1. Grading: In accordance with rules certified by ALSC; www.alsc.org.

2.04 WOOD PANEL INTERIOR SLATWALL

- A. Softwood Lumber: Wester Red Cedar species, smooth sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.
 - 1. Size: Nominal 1 x 6 square edge.
 - 2. Flame Spread Rating: 45 (Class II)
 - 3. Smoke Developed Classification: 125
 - 4. Grading: In accordance with rules certified by ALSC; www.alsc.org.
- B. Fabricate material to profiles and sizes required to produce slatwall components as indicated on drawings.
- C. Finish: Shop finish, transparent stain and seal.

2.05 LUMBER MATERIALS - EXTERIOR

- A. Softwood Lumber: Redwood species, smooth sawn, maximum moisture content of 6 percent; Clear Aye; or Heart B grade for gate and fence infill.

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1. Grading: In accordance with rules certified by ALSC; www.alsc.org.

2.06 SHEET MATERIALS

- A. Softwood Plywood, Exposed to View: A-C Grade, plain sawn, veneer core, glue type as recommended for application.
 1. Grading: Certified by the American Plywood Association.
 2. Face Veneer: APA PRP-108 Group 2; Port Orford Cedar or Western Hemlock; sanded.
- B. Softwood Plywood, for telecommunications backboards: 3/4 inch AC Grade, veneer core, fire retardant treated and pre-painted.
 1. Grading: Certified by the American Plywood Association.

2.07 FASTENINGS

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for requirements for low-emitting materials.
- B. Adhesives: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- C. Fasteners: Of size and type to suit application; plated finish in concealed locations and stainless steel finish in exposed locations.
- D. Fasteners for Exterior Applications: Stainless steel; length required to penetrate wood substrate 1-1/2 inch minimum.
- E. Concealed Joint Fasteners: Threaded steel.

2.08 ACCESSORIES

- A. Lumber for Shimming and Blocking: Softwood lumber of pine or fir species.
- B. Aluminum Edge Trim: Extruded flat shape; smooth surface finish; self locking serrated tongue; of width to match component thickness; clear anodized finish. Provide profiles as indicated on drawings and as required to neatly trim exposed edges.
- C. Primer: See Section 09 90 00 - Painting.
- D. Wood Filler: Oil base, tinted to match surface finish color.

2.09 HARDWARE

- A. Slatwall Hardware:

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1. Slatwall Inserts: 8'-0" long aluminum slatwall inserts for custom installation as indicated, and ready to accept slatwall hangers and display units.
 - a. Product: Discount Shelving and Displays, Inc. "Item No. SWM18" or equal.
 - b. Finishes: Manufacturer's silver or black color, as selected by Architect.
- B. Picture Rail: Fry Reglet Model No. DRMH-50, or equal; clear anodized aluminum.
- C. Miscellaneous Aluminum Trim Profiles: As indicated on drawing details. Fry Reglet, or equal; clear anodized aluminum.
- D. Shelf Standards: Angle braced style, gray powder-coated finish. Sizes as indicated on drawing details.
- E. Specialty Concealed Shelf Brackets:
 1. Material: Length and thickness as indicated on drawings; left and right concealed mounting configurations as required.
 2. Welded steel tee-shaped bracket, 2 1/2 inch width with 6 pre-drilled holes for screw attachment to side of stud; one countersunk hole for anchorage to underside of shelf.
 3. Weight capacity 200 pounds per bracket.
 4. Finish: Manufacturer's standard, factory-applied.
 5. Manufacturers: Right On Bracket; www.rightonbracket.com

2.10 WOOD TREATMENT

- A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.
- B. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
- C. Shop pressure treat wood materials requiring fire rating to concealed wood blocking.
- D. Provide identification on fire retardant treated material.
- E. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

2.11 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.

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- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.12 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
1. Transparent: Stain, and seal exposed to view surfaces.
 - a. Interior Wood Stain and Sanding Sealer:
 - 1) UGL; Zar wood stain.
 - 2) Sherwin-Williams; Minwax Wood Stain.
 - 3) PPG Deft Water Based Wood Stain DFT300 Series.
 - b. Sealer:
 - 1) Rust-Oleum; Varathane Diamond 2000.
 - 2) Sherwin-Williams; Minwax Clear Sealer.
 - 3) PPG Deft Sanding Sealer Interior Water Based DFT61.
 2. Opaque:
 - a. Primer: Compliant with VOC limitations and compatible with field-applied finish as specified in Section 09 90 00 - Painting
- D. Seal internal surfaces and semi-concealed surfaces. Brush apply only.
- E. Prime paint surfaces in contact with cementitious materials.
- F. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. See Section 06 10 00 - Rough Carpentry for installation of recessed wood blocking.

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3.02 INSTALLATION

- A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure materials and components in place, plumb and level.
- C. Install metal trims level, plumb, and neatly aligned.
- D. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.03 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- B. Site Finishing: See Section 09 90 00 - Painting.
- C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.04 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

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SECTION 06 41 00 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Cabinet hardware.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 81 13 - Sustainable Design Requirements: Requirements for certified wood and low-emitting materials.
- C. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- D. Section 08 80 00 - Glazing: Glass for casework.
- E. Section 12 36 00 - Countertops.

1.03 REFERENCE STANDARDS

- A. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 4.0 2021.
- B. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.
- C. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- D. WI (CCP) - Certified Compliance Program (CCP) Current Edition.
- E. WI (CSIP) - Certified Seismic Installation Program (CSIP) Current Edition.

1.04 DEFINITIONS

- A. Exposed surfaces include all surfaces visible when:
 - 1. Drawers and opaque doors (if any) are closed.
 - 2. Areas behind clear glass doors.
 - 3. Bottoms of cabinets 42-inches or more above finished floor.
 - 4. Top of cabinets below 78-inches above finished floor.

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B. Semi-exposed surfaces include the following:

1. Open opaque doors or extended drawers.
2. Bottoms of cabinets that are more than 30-inches and less than 42-inches above finished floor.

C. Concealed surfaces include the following:

1. Surfaces not visible after installation.
2. Bottoms of cabinets less than 30-inches above finished floor.
3. Tops of cabinets over 78-inches above finish floor and not visible from an upper level.
4. Stretchers, blocking, and components concealed by drawers.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

1.06 SUBMITTALS

- A. CALGreen Submittals: Provide the following:
1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
 2. Product Data for CALGreen 5.504.4.3 – Finish Material Pollutant Control; Architectural paints and coatings, including printed statement of VOC content and chemical components.
 3. Product Data for CALGreen 5.504.4.5 – Composite Wood Products: For composite-wood products, showing requirements for formaldehyde as specified in Table 5.504.4.
 4. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for certified wood and low-emitting materials.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

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1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
 2. Show details full size.
 3. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
 4. Include certification program label.
 5. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
- C. Product Data: Provide data for hardware accessories.
- D. Samples:
1. Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.
 2. Veneer-faced panel products with or for transparent finish, 12 by 24 inches (300 by 600 mm), for each species and cut. Include at least one face-veneer seam and edge condition, finished as specified.
 3. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
 4. Thermoset decorative-panels, 8 by 10 inches, for each type, color, pattern, and surface finish, with edge banding on 1 edge.
- E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- F. Sustainable Design Submittal: Documentation for sustainably harvested wood-based components.

1.07 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
 2. Single Source Responsibility: Provide and install this work from single fabricator.
- B. Quality Certification:

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1. Comply with WI (CCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section:
<https://woodworkinstitute.com/#sle>.
2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
6. Replace, repair, or rework all work for which certification is refused.

C. Forest Stewardship Council (FSC) Certified Products:

1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Forest Certification: Provide components made with not less than 50 percent of wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1.08 MOCK-UP

- A. Provide mock-up of typical base cabinet and wall cabinet with mesh infill panel, including hardware, finishes, and plumbing accessories.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.
- B. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in this Section.

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1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.11 FIELD MEASUREMENTS All casework dimensions shall be field verified prior to fabrication.

- A. All casework dimensions shall be field verified prior to fabrication.

PART 2 PRODUCTS

2.01 GENERAL PRODUCT REQUIREMENTS

- A. Provide materials that comply with requirements of NAAWS's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Single Source Responsibility: Provide and install this work from single fabricator.

2.02 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom grade.
 - 1. Cabinet doors indicated to receive glazing or metal mesh infill panels shall be constructed as stile and rail units with solid lumber frame. Frames fabricated from MDF substrate material are not acceptable.
- C. Cabinets:
 - 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
 - 2. Finish - Exposed Interior Surfaces: Decorative laminate.
 - 3. Finish - Semi-Exposed Surfaces: Decorative laminate

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4. Finish - Concealed Surfaces: Manufacturer's option.
5. Casework Construction Type: Type A - Frameless.
6. Interface Style for Cabinet and Door: flush overlay.
7. Layout for Cabinet and Door Fronts: Flush panel.
 - a. Custom Grade: Doors, drawer fronts and false fronts wood grain patterns to run and match vertically within each cabinet unit.
8. Adjustable Shelf Loading: 50 lbs. per sq. ft.
 - a. Deflection: L/144.
9. Cabinet Style: Flush overlay.
10. Cabinet Doors and Drawer Fronts: Flush style.
11. Drawer Side Construction: Multiple-dovetailed.
12. Drawer Construction Technique: Dovetail joints.

2.03 WOOD-BASED COMPONENTS

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for requirements for low-emitting materials, Adhesives and Sealants.
- B. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for requirements for low-emitting materials, Composite Wood Products.
- C. Certified Wood: Wood shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- D. Wood fabricated from old growth timber is not permitted.
- E. Hardwood and Softwood Lumber: Custom graded in accordance with NAAWS; average moisture content of 8 percent.
 1. Species: Any closed-grain hardwood. For use at concealed areas only.
- F. Cabinet and Shelf Substrate: MDF: ANSI A208.2, Grade mr-50, made with binder containing no urea-formaldehyde resin; 3/4-inch Medite II, interior grade woodbased composite panels manufactured from softwood fibers with minimum 90% preconsumer recycled wood combined with formaldehyde-free synthetic resin, with clear sealer.
 1. Acceptable Products: SierraPine's "Medex," "Medex NC," and "Medite II" and Weyerhaeuser's "Premier Plus".

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- G. Sitrle and Rail Door Substrate: Plywood: Domestic ANSI/HPVA HP-1 with both faces Grade A.

1. Thickness: 1 inch.

2.04 LAMINATE MATERIALS

- A. Manufacturers:

1. Basis-of-Design Product: Formica Infiniti colorcore2; through-color laminate; super-matte finish.
2. Acceptable Products:
 - a. Panolam Industries International, Inc; Nevamar ThruColor: www.panolam.com/#sle.
 - b. Panolam Industries International, Inc; Pionite ThruColor: www.panolam.com/#sle.
 - c. Wilsonart Solicor: www.wilsonart.com/#sle

- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

- C. Provide specific types as indicated.

1. Horizontal and Vertical Surfaces: HGS, 0.048 inch nominal thickness, color as selected from manufacturer's complete range, super matte finish.
2. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, white color, satin finish.
3. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.05 METAL MESH INFILL PANELS

- A. Metal mesh - hexagonal perforated aluminum panels in cabinet doors where indicated;

1. McNichols standard pattern: Hexagonal, HONEYCOMB 2079, Aluminum, Alloy 3003-H14, 0320" Thick (20 Gauge), 1/4" Hexagonal on 9/32" Staggered Centers, 1/32" Bar Width, 16.09 Holes Per Square Inch (HPSI), Minimum Solid Margins Both Sides of Sheet Parallel to Length of Sheet, Holes Sheared Through Both Ends of Sheet Parallel to Width of Sheet, 79% Open Area
2. Mill finish.

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3. Set into cabinet doors with stops and sealant similar to those used for glazing.

2.06 ACCESSORIES

- A. Adhesive: FS MMM-A-130 contact adhesive; type recommended by laminate manufacturer to suit application. Comply with requirements of Section 01 81 13 - Sustainable Design Requirements for low-emitting materials.
- B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
 1. Color: As indicated on drawings.
 2. Use at all exposed plywood edges.
 3. Use flat profile where indicated for edges and stops at stile and rail doors.
 4. Use at all exposed shelf edges.
- C. Glass: Type laminated as specified in Section 08 80 00.
- D. Fasteners: Size and type to suit application.
- E. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- F. Concealed Joint Fasteners: Threaded steel.
- G. Grommets: Standard plastic or rubber grommets for cut-outs, in color to match adjacent surface.

2.07 HARDWARE

- A. Hardware: BHMA A156.9, types as indicated for quality grade specified.
- B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
- C. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers.
- D. Cabinet Locks at all doors and drawers: Keyed cylinder, two keys per lock, keyed alike in each room, master keyed, steel with chrome finish.
- E. Drawer Slides:
 1. Type: Full extension.

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2. Static Load Capacity: Extra Heavy Duty grade.
 3. Mounting: Side mounted.
 4. Stops: Integral type.
 5. Features: Provide self closing/stay closed type.
 6. Manufacturers:
 - a. Accuride International, Inc; Heavy-Duty Drawer Slides: www accuride.com/#sle.
 - b. Grass America Inc: www.grassusa.com/#sle.
 - c. Knappe & Vogt Manufacturing Company; Heavy-Duty Drawer Slides: www.knappeandvogt.com/#sle.
- F. Hinges: European style concealed self-closing type, steel with nickel-plated finish.
1. Manufacturers:
 - a. Grass America Inc: www.grassusa.com/#sle.
 - b. Hettich America, LP: www.hettich.com/#sle.

2.08 FABRICATION

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- B. Fabricate woodwork to dimensions, profiles, and details indicated.
- C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 1. Seal edges of openings in countertops with a coat of varnish.
- E. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

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- F. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- G. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- H. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - 2. Cap exposed plastic laminate finish edges with plastic trim.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- B. Verify adequacy of backing and support framing.
- C. Verify location and sizes of utility rough-in associated with work of this section. Verify that mechanical, electrical, plumbing and other building items are in place, complete and ready to receive the work of this Section.
- D. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing material and backpriming.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- F. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose. Refinish cut surfaces, and repair damaged finish at cuts.

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G. Secure cabinets to floor using appropriate angles and anchorages.

1. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation.

H. Secure and anchor countertops specified in other Sections.

3.03 ADJUSTING

A. Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Adjust joinery for uniform appearance.

B. Provide seismic anchorage for casework in accordance with drawing details.

C. Adjust moving or operating parts to function smoothly and correctly.

D. Repair damaged and defective casework, where possible, to eliminate functional and visual defects; where not possible to repair, replace casework.

3.04 PROTECTION AND CLEANING

A. Protect casework after installation; do not allow other trades to use countertops as footstools or ladders to perform their work.

B. Prior to Final Completion, remove and dispose of protective coverings. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

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SECTION 06 83 16 - FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass reinforced plastic panels.
- B. Trim.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.

1.03 REFERENCE STANDARDS

- A. 9 CFR 416.2 - Regulatory Requirements Under the Federal Meat Inspection Act and the Poultry Products Inspection Act, Part 416-Sanitation current edition.
- B. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor 2013a.
- C. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.
- D. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels 2017.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

1.04 SUBMITTALS

- A. CALGreen Submittals: Provide the following:
 - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

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- C. Samples: Submit two samples 6 inch by 6 inch in size illustrating material and surface design of panels.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fiberglass Reinforced Plastic Panels:
1. Marlite, Inc: www.marlite.com/#sle.
 2. Nudo Products, Inc: www.nudo.com/#sle.
 3. Panolam Industries International, Inc; Panolam FRP: www.panolam.com/#sle.

2.02 PANEL SYSTEMS

- A. Wall Panels:
1. Panel Size: 4 by 8 feet.
 2. Panel Thickness: 0.10 inch.
 3. Surface Design: Smooth.
 4. Color: As selected by Architect.
 5. Attachment Method: Adhesive only, with trim and sealant in joints.

2.03 MATERIALS

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Scratch Resistance: Barcol hardness score greater than 35, when tested in accordance with ASTM D2583.
 4. Sanitation and Cleanability: Comply with 9 CFR 416.2.

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- B. Trim: Vinyl; color coordinating with panel.
- C. Fasteners: Nylon rivets.
- D. Adhesive: Type recommended by panel manufacturer.
- E. Sealant: Type recommended by panel manufacturer; color matching panel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Pre-drill fastener holes in panels, 1/8 inch greater in diameter than fastener, spaced as indicated by panel manufacturer.
- D. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- E. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- F. Install panels with manufacturer's recommended gap for panel field and corner joints.
- G. Drive fasteners to provide snug fit, and do not over-tighten.
- H. Place trim on panel before fastening edges, as required.
- I. Fill channels in trim with sealant before attaching to panel.
- J. Install trim with adhesive and screws or nails, as required.
- K. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- L. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

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SECTION 07 13 00 - SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sheet Waterproofing:
 - 1. Self-adhered modified bituminous sheet membrane system.
 - 2. PMMA-Based flashing at steel column bases below exterior pavement.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 03 30 00 - Cast-in-Place Concrete: Concrete substrate.
- C. Section 07 92 00 - Joint Sealants: Sealing moving joints in waterproofed surfaces that are not required to be treated in this section.

1.03 REFERENCE STANDARDS

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016 (Reapproved 2021).
- B. ASTM D570 - Standard Test Method for Water Absorption of Plastics 1998 (Reapproved 2018).
- C. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds 1998 (Reapproved 2017).
- D. ASTM D1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test) 2008, with Editorial Revision (2015).
- E. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.
- F. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes 2020.
- G. ASTM D6506/D6506M - Standard Specification for Asphalt Based Protection Board for Below-Grade Waterproofing 2001, with Editorial Revision (2018).
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

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- I. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover 2008a, with Editorial Revision (2013).
- J. NRCA (WM) - The NRCA Waterproofing Manual 2005.

1.04 SUBMITTALS

- A. CALGreen Submittals: Provide the following:
 - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
- B. Product Data: Provide data for membrane, surface conditioner, and joint and crack sealants.
- C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- D. Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in District's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Membrane Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.07 WARRANTY

- A. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to District.

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PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials, Adhesives and Sealants.

2.02 MEMBRANE MATERIALS

- A. Self-Adhered Modified Bituminous Sheet Membrane:
1. Thickness: 60 mil, 0.060 inch, minimum.
 2. Sheet Width: 36 inches, minimum.
 3. Tensile Strength:
 - a. Film: 5,000 psi, minimum, measured in accordance with ASTM D882 and at grip-separation rate of 2 inches per minute.
 - b. Membrane: 325 psi, minimum, measured in accordance with ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches per minute.
 4. Elongation at Break: 300 percent, minimum, measured in accordance with ASTM D412.
 5. Water Vapor Permeance: <0.1 perm, maximum, measured in accordance with ASTM E96/E96M.
 6. Low Temperature Flexibility: Unaffected when tested in accordance with ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.
 7. Peel Strength: 9 lb per inch, minimum, when tested in accordance with ASTM D903.
 8. Lap Adhesion Strength: 5 lb per inch, minimum, when tested in accordance with ASTM D1876.
 9. Puncture Resistance: 50 lb, minimum, measured in accordance with ASTM E154/E154M.
 10. Water Absorption: 0.1 percent increase in weight, maximum, measured in accordance with ASTM D570, 24 hour immersion.
 11. Hydrostatic Resistance: Resists the weight of 200 ft when tested in accordance with ASTM D5385/D5385M.

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12. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
13. Manufacturers:
 - a. Carlisle Coatings & Waterproofing Inc; MiraDRI 860/861: www.carlisleccw.com/#sle.
 - b. GCP Applied Technologies; Bituthene 4000: www.gcpat.com/#sle.
 - c. Soprema; Colphene 3000.

2.03 PMMA-BASED FLASHING

- A. Polymethyl methacrylate reinforced flashing system including:
 1. PMMA primer(s) suitable for use over concrete footing and column base.
 2. Self-Adhesive Modified Bitumen Stripping Ply and Flashing Reinforcing Sheet.
 3. PMMA-based flashing resin.
 4. Non-woven polyester fleece flashing resin.
- B. Manufacturers:
 1. Kemper; Kemperol 2k-PUR system.
 2. Siplast; ParaPro 123 system.

2.04 ACCESSORIES

- A. Attachment Materials:
 1. Battens and termination bars: Stainless steel.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Membrane Sealant: As recommended by membrane manufacturer.
- D. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.
- E. Protection Board: Provide type capable of preventing damage to waterproofing due to backfilling and construction traffic.
 1. Multi-layer internally-reinforced asphaltic panels, 1/8 inch thick, nominal, complying with ASTM D6506/D6506M.

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- F. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.
 - 1. Composition: Dimpled polystyrene, polyethylene, or polypropylene core; polypropylene filter fabric.
- G. Cant Strips: Premolded composition material.
- H. Flexible Flashings: Type recommended by membrane manufacturer.
- I. Surface Conditioner: Compatible with membrane.
- J. Adhesives: As recommended by membrane manufacturer.
 - 1. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
- C. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

- A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.
- B. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.
- C. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.

3.03 INSTALLATION - MEMBRANE

- A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- B. Roll out membrane, and minimize wrinkles and bubbles.
- C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.
- D. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.

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- E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
- F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.
- G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
- H. Seal membrane and flashings to adjoining surfaces.

3.04 INSTALLATION - DRAINAGE PANEL and PROTECTION BOARD

- A. Place protection board directly against membrane; butt joints. Scribe and cut boards around projections, penetrations, and interruptions.
- B. Adhere protection board to substrate with compatible adhesive.

3.05 INSTALLATION - PMMA-BASED FLASHING

- A. Install PMMA-Based flashing system in full accordance with manufacturer's published preparation and installation methods.
- B. Install flashing to cover steel column and post bases. Cure fully prior to placement of pavement system.
- C. Extend flashing to cover the column baseplate, fasteners, and top of footing, extending fully around each steel member leaving no exposed metal.

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SECTION 07 21 00 - BUILDING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Batt insulation and vapor retarder in exterior wall construction.
- B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.
- C. Board insulation and integral vapor retarder behind fiber cement soffit panels.
- D. Acoustic insulation in interior wood framed construction.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 81 13 - Sustainable Design Requirements: Requirements for certified wood and low-emitting materials.
- C. Section 07 27 26 - Sheet-Applied Membrane Air Barriers, Vapor Impermeable
- D. Section 07 41 13 - Metal Roof Panels - Standing Seam - Standing Seam: Rigid insulation under metal roof system
- E. Section 07 46 46 - Fiber Cement Panels: Exterior soffit panels.
- F. Section 07 84 00 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.
- G. Section 07 92 00 - Joint Sealants: Sealants including acoustical sealant.
- H. Section 09 29 00 - Gypsum Board: Gypsum board assemblies applied to wood framing, including exterior gypsum sheathing.

1.03 REFERENCE STANDARDS

- A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- B. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

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- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- E. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C 2019a.

1.04 SUBMITTALS

- A. CALGreen Submittals: Provide the following:
 - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
 - 2. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Include information on installation techniques.

1.05 QUALITY ASSURANCE

- A. Installer Qualification: Use accredited contractors, certified installers, evaluated materials, and third-party field quality control audit.
- B. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.06 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation behind fiber cement soffit panels: Rigid or semi-rigid mineral fiber board.
- B. Insulation in Wood Framed Walls: Batt insulation with integral vapor retarder.

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- C. Acoustical Insulation in Interior Wall and Ceiling Assemblies: Batt insulation with no vapor retarder

2.02 FIBERBOARD INSULATION MATERIALS

- A. Where fiberboard insulation is indicated, either rock, slag, or glass mineral fiberboard insulation may be used, at Contractor's option.
- B. Mineral Fiberboard Insulation: Rigid mineral fiber, in accordance with ASTM C612.
1. Facing: None, unfaced.
 2. Flame Spread Index: 25 or less, when tested with facing, if any, in accordance with ASTM E84.
 3. Smoke Developed Index: 50 or less, when tested with facing, if any, in accordance with ASTM E84.
 4. Board Size: 48 by 48 inch.
 5. Board Thickness: As indicated in details.
 6. Board Edges: Square.
 7. Combustibility: Except for facing, if any, non-combustible when tested in accordance with ASTM E136.
 8. Manufacturer:
 - a. Johns Manville: www.jm.com/#sle.
 - b. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 - c. ROCKWOOL (ROXUL, Inc): www.rockwool.com/#sle.
- C. Mineral Fiberboard Insulation: Rigid or semi-rigid mineral fiber, ASTM C612 or ASTM C553; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
1. Provide fiberglass reinforced polypropylene facing on one side; with flame spread index of 25 or less, when tested in accordance with ASTM E84.
 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 3. Board Size: 16 by 48 inches.
 4. Board Thickness: As indicated on details.
 5. Manufacturer:

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- a. Johns Manville: www.jm.com/#sle.
- b. ROCKWOOL (ROXUL, Inc): www.rockwool.com/#sle.
- c. Thermafiber, Inc: www.thermafiber.com/#sle.

2.03 BATT INSULATION MATERIALS

- A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 4. Formaldehyde Content: Zero.
 5. Thermal Resistance: R-value of 19 for 6 inch stud walls.
 6. Facing: Asphalt treated Kraft paper, one side.
 7. Products:
 - a. CertainTeed Corporation: www.certainteed.com/#sle.
 - b. Johns Manville: www.jm.com/#sle.
 - c. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
- B. Glass Fiber Acoustic Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 4. Formaldehyde Content: Zero.
 5. Thickness: Full depth of framing.
 6. Facing: Unfaced.

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7. Products:

- a. CertainTeed Corporation: www.certainteed.com/#sle.
- b. Johns Manville: www.jm.com/#sle.
- c. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

2.04 ACCESSORIES

- A. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
 - 1. Application: Sealing of interior circular penetrations, such as pipes or cables.
 - 2. Width: Are required for application.
 - 3. Temperature Resistance: Minus 40 degrees F to 212 degrees F
- B. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.
- C. Insulation Fasteners for Unfaced Batts: Lengths of unfinished, 13 gauge, 0.072 inch high carbon spring steel with chisel or mitered tips, held in place by tension, length to suit insulation thickness and substrate, capable of securely supporting insulation in place.
- D. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

3.02 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior wall spaces and at interior walls between conditioned and un-conditioned areas. Install without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Install with factory-applied vapor retarder membrane facing winter warm side of building spaces. Lap ends and side flanges of membrane over framing members.

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- F. Staple or nail facing flanges in place at maximum 6 inches on center to the interior face of framing.
- G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
- H. Coordinate work of this section with construction of air barrier seal specified in Section 07 27 26 - Sheet-Applied Membrane Air Barriers, Vapor Impermeable.

3.03 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

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SECTION 07 27 26 - SHEET-APPLIED MEMBRANE AIR BARRIERS, VAPOR IMPERMEABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Materials and installation methods for sheet-applied, vapor impermeable air barrier membrane system located in the non-accessible part of the wall.
- B. Materials and installation methods to bridge and seal air leakage pathways in roof and foundation junctions, window and door openings, control and expansion joints, masonry ties, piping and other penetrations through the wall assembly.

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- C. Section 03 30 00 – Cast-In-Place Concrete
- D. Section 07 41 13 - Metal Roof Panels - Standing Seam
- E. Section 07 53 00 – Elastomeric Membrane Roofing
- F. Section 07 62 00 – Sheet Metal Flashing and Trim
- G. Section 07 92 00 – Joint Sealants
- H. Section 09 29 00 - Gypsum Board: Gypsum Sheathing for wood-framed construction

1.03 DEFINITIONS

- A. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.04 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-impermeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

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B. The building envelope shall be designed and constructed with a continuous air barrier to control air leakage into, or out of the conditioned space. An air barrier shall also be provided for interior partitions between conditioned space and space designed to maintain temperature or humidity levels which differ from those in the conditioned space by more than 50% of the difference between the conditioned space and design ambient conditions. The air barrier shall have the following characteristics:

1. It must be continuous, with all joints made airtight.
2. It shall have an air permeability not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.02 L/s. x sq. m. @ 75 Pa), when tested in accordance with ASTM E2178.
3. It shall have an air permeability not to exceed 0.04 cfm/sq. ft. under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.2 L/s. x sq. m. @ 75 Pa), when tested in accordance with ASTM E2357.
4. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
5. It shall be durable or maintainable.
6. The air barrier shall be joined in an airtight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between:
 - a. Foundation and walls
 - b. Walls and windows or doors
 - c. Different wall systems
 - d. Wall and roof
 - e. Wall and roof over unconditioned space
 - f. Walls, floor and roof across construction, control and expansion joints
 - g. Walls, floors and roof to utility, pipe and duct penetrations
 - h. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.

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1.05 REFERENCES

- A. The following standards and publications are applicable to the extent referenced in the text. The most recent version of these standards is implied unless otherwise stated.
- B. American Society for Testing and Materials (ASTM) and National Fire Protection Association (NFPA)
1. ASTM C1193 Guide for Use of Joint Sealants
 2. ASTM D412 Standard Test Methods for Rubber Properties in Tension
 3. ASTM D570 Standard Test Method for Water Absorption of Plastics
 4. ASTM D1004 Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting
 5. ASTM D1876 Test Method for Peel Resistance of Adhesives
 6. ASTM D1938 Standard Test Method for Tear-Propagation Resistance (Trouser Tear) of Plastic Film and Thin Sheeting by a Single-Tear Method
 7. ASTM D1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 8. ASTM D4258 Practice for Surface Cleaning Concrete for Coating
 9. ASTM D4263 Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
 10. ASTM D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
 11. ASTM E96 Test Methods for Water Vapor Transmission of Materials
 12. ASTM E154 Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
 13. ASTM E1105 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
 14. ASTM E1186 Practice for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems
 15. ASTM E2178 Standard Test Method for Air Permeance of Building Materials

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16. ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
17. NPFA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

1.06 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
- B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 1. Include details of interfaces with other materials that form part of air barrier
 2. Include details of mockups
- C. Submit representative samples of the following for approval:
 1. Sheet-Applied membrane
 2. Self-Adhered Transition Membrane
- D. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with project materials that connect to or that come in contact with the barrier; signed by product manufacturer.
- E. Qualification Data: For Applicator.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers, submit certified test report showing compliance with requirements specified for ASTM E2178.
- G. Warranty: Submit a sample warranty identifying the terms and conditions specified in this Section.

1.07 QUALITY ASSURANCE

- A. Manufacturer: Air barrier systems shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of waterproofing and air barriers.

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- B. Source Limitations: Obtain primary air-barrier material and all air barrier assembly materials through one source from a single manufacturer. Should project require a vapor permeable and a vapor impermeable air barrier on same project, obtain vapor-permeable and vapor impermeable air barrier and through wall flashing from one source from a single manufacturer.
- C. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- D. Mockups: Before beginning installation of air barrier, provide air barrier work for exterior wall assembly mockups, incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
 - 1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed
 - 2. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved
- E. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Preinstallation conference shall include the Contractor, installer, Architect, and system manufacturer's field representative. Agenda for meeting shall include but not be limited to the following:
 - 1. Review of submittals
 - 2. Review of surface preparation, minimum curing period and installation procedures
 - 3. Review of special details and flashings
 - 4. Sequence of construction, responsibilities and schedule for subsequent operations
 - 5. Review of mock-up requirements
 - 6. Review of inspection, testing, protection and repair procedures

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

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- B. Do not double-stack pallets of sheet applied membrane components on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
- C. Protect sheet-applied membrane components from freezing and extreme heat.
- D. Sequence deliveries to avoid delays, but minimize on-site storage.

1.09 PROJECT CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a wet substrate or during snow, rain, fog, or mist.

1.10 WARRANTY

- A. Submit manufacturer's warranty that air barrier and accessories are free of defects at time of delivery and are manufactured to meet manufacturer's published physical properties and material specifications.
- B. Warranty Period: Five years from date of completion of the air barrier membrane installation.

PART 2 PRODUCTS

2.01 SHEET-APPLIED, VAPOR IMPERMEABLE MEMBRANE AIR BARRIER

- A. Basis of Design: Perm-A-Barrier® NPS, as manufactured by GCP Applied Technologies, 62 Whittemore Avenue, Cambridge, MA; 0.012 inch adhesive, 0.004 inch HDPE / AL, sheet-applied, vapor impermeable membrane that forms a resilient, monolithic, fully bonded elastomeric membrane when applied to construction surfaces.
- B. Other Acceptable Systems: Manufacturer must be capable of providing all required products as part of a fully compatible system that fulfils the specified performance requirements.
 - 1. Carlisle: www.carlisleccw.com.
 - 2. Tremco: www.tremcosealants.com
- C. Product Characteristics:
 - 1. Membrane Air Permeance: ASTM E2178: Not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.02 L/s. x sq. m. @ 75 Pa)
 - 2. Assembly Air Permeance: Provide a continuous air barrier assembly that has an air leakage not to exceed 0.04 cfm/sq. ft. of surface area under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.2 L/s. x sq. m. of surface area at 75 Pa) when tested

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in accordance with ASTM E2357.

3. Water Resistance: ASTM E331: Pass at 15 psf or greater.
 4. Water Vapor Permeance: ASTM E96, Method A: < 1 perm
 5. Water Vapor Permeance: ASTM E96, Method B: < 1 perm
 6. Elongation: ASTM D412-Die C: minimum 200%
 7. Low temperature flexibility and crack bridging: ASTM C1305: Pass.
 8. Nail sealability: ASTM D1970: Pass.
 9. Fire Resistance: Evaluated to NFPA 285 as part of various wall assemblies
- D. TRANSITION ALUMINUM MEMBRANE: At rough openings provide Perm-A-Barrier Aluminum flashing manufactured by GCP Applied Technologies; a 0.9 mm (35 mils) of self-adhesive rubberized asphalt integrally bonded to 0.1 mm (5 mil) of aluminum film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:
1. Water Absorption: ASTM D570: max 0.1% by weight
 2. Puncture Resistance: ASTM E154: 355N (80 lbs) min.
 3. Lap Adhesion at minus 4 degrees Celsius (25 degrees Fahrenheit): ASTM D1876 Modified: 880 N/m (5.0 lbs./in.) of width
 4. Low Temperature Flexibility: ASTM D1970 Modified: Unaffected to minus 26 degrees Celsius (minus 15 degrees Fahrenheit)
 5. Tensile Strength: ASTM D412, Die C Modified: minimum 4.1 MPa (600 Psi)
 6. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C Modified: minimum 200%

2.02 PENETRATIONS & TERMINATION SEALANT

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials, Adhesives and Sealants.
- B. Liquid Membrane for Details and Terminations and Substrate Patching: Bituthene Liquid Membrane manufactured by GCP Applied Technologies; a two-part, elastomeric, trowel grade material designed for use with sheet-applied membranes, self-adhered membranes and tapes. 10 g/L maximum VOC content.

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- C. Sealant for Details, Final Terminations and Sheathing: Grace S100 Sealant manufactured by GCP Applied Technologies: a one-part, neutral curing, ultra low modulus material designed for use with SHEET-applied membranes, self-adhered membrane and tapes. 98 g/L maximum VOC content.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrates and conditions are ready to accept the Work of this section. Notify architect in writing of any discrepancies. Commencement of the Work or any parts thereof shall mean acceptance of the prepared substrates.
- B. All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants detrimental to the adhesion of the membranes. Fill voids, gaps and spalled areas in substrate to provide an even plane.
- C. Curing compounds or release agents used in concrete construction must be resin based without oil, wax or pigments.

3.02 SURFACE PREPARATION

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the sheet-applied air barrier assembly.
- B. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws.
- C. Related Materials: Treat construction joints and install flashing as recommended by manufacturer.
- D. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
- E. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- F. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- G. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.

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- H. At changes in substrate plane, apply Bituthene Liquid Membrane at sharp corners and edges to form a smooth transition from one plane to another.
- I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.03 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D4258 before coating surfaces.

3.04 AIR BARRIER MEMBRANE INSTALLATION

- A. Apply air barrier membrane to achieve a continuous air barrier according to air barrier manufacturer's written instructions.
- B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.
- C. Roll installed membrane with a hand roller.
- D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.05 PREFABRICATED WINDOW CORNER INSTALLATION

- A. Install prefabricated window corners into rough openings of windows at bottom corners of the window openings prior to installing primer and transition membrane. Install the corners into the rough opening in accordance with manufacturer's installation instructions.

3.06 TRANSITION MEMBRANE INSTALLATION

- A. Install strips, transition membrane, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
- B. Apply primer to substrates to receive transition membrane at required rate and allow to dry. Limit priming to areas that will be covered by transition tape in same day. Re-prime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing not covered with air membrane material with number of prime coats needed to achieve required bond, with adequate drying

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time between coats.

- C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, exterior glazing and window systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
 - 1. Adhesion Testing: If the roofing membrane is provided by a different manufacturer, perform adhesion testing to assure compatibility before proceeding with installation.
- D. At end of each working day, seal top edge of strips and transition membrane to substrate with termination sealant.
- E. Apply joint sealants forming part of air barrier assembly within sealant manufacturer's recommended application temperature ranges. Consult sealant manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed perimeter frame surfaces of windows, storefronts, and doors. Apply transition membrane so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates. Roll firmly to enhance adhesion.
- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
- H. Repair punctures, voids, and deficient lapped seams in strips and transition membrane. Slit and flatten fish-mouths and blisters. Patch with transition membrane extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 - 1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes
 - 2. Continuous structural support of air barrier system has been provided
 - 3. Concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings
 - 4. Site conditions for application temperature and dryness of substrates have been maintained

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5. Maximum exposure time of materials to UV deterioration has not been exceeded
 6. Surfaces have been primed, if applicable
 7. Laps in strips and transition membrane have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fish-mouths
 8. Termination sealant has been applied on cut edges
 9. Strips and transition membrane have been firmly adhered to substrate
 10. Compatible materials have been used
 11. Transitions at changes in direction and structural support at gaps have been provided.
 12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal
 13. All penetrations have been sealed
- C. Tests: Testing to be performed will be determined by Owner's testing agency from among the following tests:
1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E1186.
 2. Test installation at windows and other openings in accordance with ASTM E1105.
- D. Remove and replace deficient air barrier components and retest as specified above.

3.08 CLEANING AND PROTECTION

- A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
- B. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace main air barrier material exposed for more than 12 months.
- C. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

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D. Remove masking materials after installation.

END OF SECTION

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SECTION 07 41 13 - METAL ROOF PANELS - STANDING SEAM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural roofing system of preformed steel panels.
- B. Low-Slope architectural roofing system of preformed steel panels.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 74 19 – Construction Waste Management and Disposal.
- C. Section 06 16 00 - Sheathing: Wood roof sheathing
- D. Section 07 21 00 - Building Insulation: Rigid roof insulation.
- E. Section 07 62 00 - Sheet Metal Flashing and Trim: Sheet metal assemblies not associated with Metal Roof Panel systems. Flexible flashing at roof expansion joint.
- F. Section 07 92 00 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.
- G. Section 08 62 00 - Unit Skylights: Unit skylights in metal panel roof assemblies.
- H. Section 09 29 00 - Gypsum Board: Cover board.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2021a.
- C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

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- E. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments 2012, with Editorial Revision (2015).
- F. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies Current Edition, Including All Revisions.
- G. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Refer to Division 1 for submittal procedures.
- C. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Summary of test results, indicating compliance with specified requirements.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Specimen warranty.
- D. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
 - 1. Show work to be field-fabricated or field-assembled.
- E. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.
- F. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.
 - 1. Include typical panel joint in sample.
- G. Test Reports: Indicate compliance of metal roofing system to specified requirements.
- H. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in District's name and are registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications:

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1. Manufacturer shall have a minimum of 10 years experience supplying metal roofing to the region where the work is to be done.
2. Comply with current independent testing and certification as specified.
3. Manufacturer shall provide proof of \$2,000,000 liability insurance for their metal roof system and comply with current independent testing and certification as specified.
4. The roof panel manufacturer must also subscribe to Underwriters Laboratories' "Follow Up Service" assuring continuing product compliance with UL requirements. Shipment packaging of panels and attachment clips must bear UL classification markings.
5. Panel manufacturers without full supporting literature; Flashings & Details Guides, Guide Specifications and Technical Support, shall not be considered equal to the specified product.

B. Installer Qualifications:

1. Installer must be approved by the Panel Manufacturer in writing prior to work commencing.
2. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience on projects of similar complexity.

1.06 PERFORMANCE REQUIREMENTS

A. Fire Rating:

1. The panel system must be UL Class A Fire Rated when installed on non-combustible deck in accordance with UL 790

B. Testing and Certification - Wind Uplift:

1. The panel system shall be ASTM E1592 tested under the supervision of an accredited laboratory and the laboratory shall issue the test report.
2. The testing laboratory shall meet the requirements for compliance with the ISO/IEC Standards 17025 or an accredited independent agency, recognized by the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement or ANSI.
3. UL 580 test, Class 90 rated per:
 - a. Construction #364 minimum 24 gauge panels when installed over 5/8" plywood, with roof panel fastener clips spaced 2'-0" on center maximum.

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C. Testing and Certification - Air Infiltration:

1. Panel to meet the following standard when in accordance with ASTM E-1680:
 - a. With factory-applied continuous sealant 0.08 cfm/lineal ft. of panel seam at 1.57 psf positive pressure, and 0.13 cfm/lineal ft. of panel seam at 1.57 psf negative pressure.

D. Testing and Certification - Water Penetration:

1. Water Penetration: Panel to meet the following standard when tested in accordance with ASTM-E1646:
 - a. With factory-applied continuous sealant, no leakage at 6.24 psf.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.
- B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.08 WARRANTY

- A. Refer to Division 1 for additional warranty requirements.
- B. Manufacturer's Product Warranty:
 1. A single warranty is required for both substrate and paint. Separate warranties are not acceptable.
 2. Manufacturer's standard performance warranty, as available for specified installation and environmental conditions.
- C. Manufacturer's Finish Product Warranty: Provide manufacturer's special warranty covering failure of factory-applied fluorocarbon finish on metal roof panels, flat stock, and accessories; and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, delamination, or peeling within specified warranty period of twenty years from Date of Substantial Completion.
 1. Will be free of fading or color change in excess of 5 Hunter delta-E units as determined by ASTM D2244-02.
 2. Will not chalk in excess of numerical rating of 8 when measured in accordance with standard procedures specified in ASTM D4214-98 method D659.

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3. Metal substrate will not rupture, fail structurally, or perforate.
- D. Manufacturer's Watertightness Warranty: Provide manufacturer's warranty for watertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of twenty years from Date of Substantial Completion.
- E. Contractor's Warranty:
 1. Warrant panels, flashings, sealants, fasteners and accessories against defective materials and/or workmanship, to remain watertight and weatherproof with normal usage for two (2) years following Project Substantial Completion date.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design:
 1. Metal Roof Panels: AEP Span Design Span HP manufactured by AEP Span.
- B. Architectural Metal Roof Panels:
 1. Berridge Manufacturing Company: www.berridge.com/#sle.
 2. Firestone Building Products LLC: www.firestonebpco.com/#sle.
 3. Morin Corporation: www.morincorp.com/#sle.
 4. Garland <https://www.garlandco.com/products/metal>.

2.02 ARCHITECTURAL METAL ROOF PANELS

- A. Architectural Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.
- B. Architectural Metal Panels: Factory-formed panels with factory-applied finish.
 1. Steel Panels:
 - a. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; minimum AZ50 coating.
 - b. Steel Strength: Minimum yield 50,000 psi,
 - c. Steel Thickness: Minimum 24 gauge (0.024 inch).

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2. Profile: Standing Seam: Roof panels shall consist of integral self-locking standing seams 1-3/4" high spaced 16 inches on center.
 - a. Striated pan.
3. Texture: Smooth, with intermediate ribs for added stiffness.
4. Length: Full length of roof slope, without lapped horizontal joints.
5. Width: Maximum panel coverage of 16 inches.

2.03 ATTACHMENT SYSTEM

- A. Concealed System: Provide manufacturer's standard UL 90 rated 18 gauge G-90 Galvanized steel, 40 ksi yield strength, 3-1/2" long triple fastener type concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.04 FABRICATION

- A. Panels: Provide factory fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.
- B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.05 FINISHES

- A. Exterior Finish:
 1. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat aluminum coil coating system complying with AAMA 2605,
 2. Primer: Baked-on 0.15-0.20 mil corrosion resistant primer.
 3. Finish Coat: Baked-on 0.70-0.80 mil finish coat with a specular gloss of 10-30% when tested in accordance with ASTM D-523 at 60°.
 4. Full 70% Kynar 500/Hylar 5000
 5. Color and as selected from manufacturer's standard range of not less than 16 non-metallic colors listed for compliance with State of California California Energy Commission requirements by the Cool Roof Rating Council (CRRC).
- B. Initial Solar Reflectance (SRI): Greater than 20 for nominally steep sloped roof >2:12.

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C. Interior Finish:

1. Primer Coat Material: Corrosion-resistant primer; primer coat dry film thickness: 0.15 mils.
2. Finish Coat material: polyester paint, finish coat dry film thickness: 0.35 mils.
3. Color: Off-White to Light Gray

2.06 ACCESSORIES

- A. All flat stock and pre-finished fasteners shall be sourced from the same manufacturer as the metal panels in order to maintain a congruent paint and finish warranty and color.
- B. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.
 1. Downspouts: Open face, rectangular profile.
- C. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.
 1. Gutter lining: Line gutters with self-adhering Thermoplastic Polyolefin (TPO) or Polyvinyl Chloride (PVC) smooth 60 mil single ply roofing membrane. Lap membrane parallel to direction of gutter flow. Provide continuous stainless steel termination bar for gutter lining at wall.
 2. Removable Leaf Litter Guards: Provide at all gutters. Maximum 1/4 inch mesh size stainless steel wire fabric.
 3. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.
- D. Sealants:
 1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
 2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
 3. Seam Sealant: Factory-applied, non-skinning, non-drying type.

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2.07 UNDERLAYMENT

- A. Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil total thickness; with strippable release film and woven polyolefin top surface.
1. Basis of Design - AEP Span Underlayment HT, or equal.
 2. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
 3. Sheet Thickness: 22 mil, 0.022 inch minimum total thickness.
 4. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
 5. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
 6. Water Absorption: 0.5% maximum when tested in accordance with ASTM D1970.
 7. Moisture Vapor Permeance: 0.02 perms when tested in accordance with ASTM D1970.
 8. Manufacturers:
 - a. Basis of Design: AEP Span Underlayment HT.
 - b. Acceptable Alternative Products:
 - 1) Firestone Clad-Gard SA.
 - 2) Garland R-Mer Seal.
 - 3) Henry Company; Blueskin PE200HT: www.henry.com/#sle.
 - 4) Polyglass USA, Inc; Polystick MTS Plus Self-Adhered High Temperature Roof Underlayment: www.polyglass.us/#sle.
 9. Tensile Strength:
 - a. Machine Direction: 250 psi.
 - b. Transverse Direction: 1390 psi.
 10. Elongations at Break:
 - a. Machine Direction: 250%.
 - b. Transverse Direction: 170%

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2.08 COVER BOARD:

- A. Fiberglass Mat Faced Gypsum Roof Board:
- B. Acceptable Products: Georgia P Gypsum, DensDeck® Prime; USG Securerock; Roof Boards.
 - 1. Thickness: 1/2 inch.
 - 2. Width: 4 feet.
 - 3. Weight: 2.0 lb/sq. ft.
 - 4. Surfacing: Primed Fiberglass Mat.
 - 5. Flexural Strength, Parallel (ASTM C473 Standard Test Methods for Physical Testing of Gypsum Panel Products): 80 lbf, minimum.
 - 6. Permeance (ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials): Greater than 23 perms.
 - 7. R-Value (ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus): 0.56.
 - 8. Water Absorption (ASTM C473): Less than 5 percent of weight.
 - 9. Surface Water Absorption (ASTM C473): Nominal 1.0 grams.
 - 10. Compressive Strength (Applicable Sections of ASTM C472 Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete): Nominal 900 pounds per square inch.
 - 11. Flame Spread/ Smoke Development (ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Material): Not more than 0 Flame Spread, 0 Smoke Development
 - 12. Combustibility (ASTM E136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 C): Noncombustible
 - 13. Fire resistance rating (UL 790 Standard Test Methods for Fire Tests of Roof Coverings; and ASTM E108 Standard Test Methods for Fire Tests of Roof Coverings): Class A
 - 14. Mold Resistance (ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber): Scored a 10

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2.09 THERMAL INSULATION

- A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
- Classification: Type II: Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of core foam.
 - Compressive Strength: Classes 1-2-3, Grade 1 - 20 psi (110 kPa), minimum.
 - Thermal Resistance, R-value: At 1-1/2 inch thick; Class 1, Grades 1-2-3 - 8.4 (1.48) at 75 degrees F.
 - Flame Spread Index, Core (FSI): Class A - 26 - 60, when tested in accordance with ASTM E84.
 - Smoke Developed Index, Core (SDI): 75-160, when tested in accordance with ASTM E84.
 - Water Vapor Transmission: <1.5 perm, when tested in accordance with ASTM E96
 - Water Absorption: <1% by volume when tested in accordance with ASTM C209
 - Board Size: 48 inch by 96 inch.
 - Dimensional Stability Length and Width: <2% linear change.
 - Board Thickness: Multi-layer installation. Total thicknesses as indicated on drawings,
 - Board Edges: Square.
 - Products shall be accepted by the metal roof system manufacturer and shall be listed by the State of California Department of Consumer Affairs in the most current edition of The Directory of Certified Insulation Materials:
 - DuPont de Nemours, Inc; THERMAX Brand: www.building.dupont.com/#sle.
 - Rmax Inc; MultiMax FA3: www.rmax.com/#sle.
 - Johns Manville: Enrgy 3: www.jm.com/en/commercial-roofing/#sle.
- B. Fasteners: Provide fasteners of types and lengths required to anchor insulation and cover board without damaging the materials penetrated. Fasteners shall be of sufficient length to penetrate the wood roof sheathing 3/8 inch minimum.
- Fasteners: Types recommended by the insulation and coverboard manufacturers.

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2. Manufacturer: Rodenhouse self-drilling ceramic coated screws #10 typical; #8 for fasteners lengths 3-inch or less, or equivalent.
3. Provide all fasteners with pronged washers.

2.10 VAPOR BARRIER

- A. Modified rubberized asphalt self-adhering vapor barrier with slip resistant walking surface.
 1. Product: Owens Corning Titanium® PSU30 or approved equal.
 2. Watertight asphalt to asphalt horizontal lap system.
 3. Up to 6 months UV exposure rating.
 4. Meets or exceeds ASTM D1970.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Examine the conditions and substrates in which metal roofing work is to be installed. Substrate shall be installed level, flat and true to avoid panel stresses and distortion.
- D. Proceed with roofing installation only after satisfactory conditions are met.
- E. No roofing shall take place until substrate and assembly is dry. Moisture in the assembly will not be tolerated.

3.02 PREPARATION

- A. Field measurements shall be taken prior to fabrication of panels.
- B. Broom clean wood sheathing prior to installation of roofing system.
- C. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.
- D. Coordinate installation of waterproof membrane with roof sheathing and insulation.
- E. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.

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- F. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.
- G. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION - GENERAL

- A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
 - 1. Install roofing system over cover board, rigid insulation and underlayment with concealed clips and fasteners.
 - 2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.
 - 3. Where openings exceed 6 inches in any direction: Shop fabricate and reinforce to maintain original load capacity.

3.04 INSTALLATION - VAPOR BARRIER, INSULATION, COVER BOARD AND UNDERLAYMENT

- A. Install semi-permeable vapor barrier loose laid over structural sheathing, stapled in place.
- B. Install thermal insulation in accordance with insulation manufacturer's published recommendations for a mechanically attached multi-layer system.
- C. Stagger insulation boards to offset joints as recommended by manufacturer.
- D. Fit insulation tightly at edges and penetrations to minimize air leakage.
- E. Install coverboard in accordance with roofing manufacturer's published recommendations for a mechanically attached system. Cut coverboard to fit tightly at edges and penetrations.
 - 1. Seal joints in conformance with requirements for a UL Class A installation.
- F. Install underlayment over cover board before installing preformed metal roof panels. Secure by methods acceptable to roof panel manufacturer, minimizing use of metal fasteners. Apply from eaves to ridge in shingle fashion, overlapping horizontal joints a minimum of 3 1/2 inches and side and end laps a minimum of 6 inches.

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3.05 INSTALLATION - ROOFING

- A. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.
- B. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.
 - 1. Lap panels away from prevailing wind direction.
 - 2. Do not stretch or compress panel side-lap.
 - 3. Secure panels without warp or deflection.
 - 4. Fully engage interlocking seams.
 - 5. Install sealant or sealant tape, as recommended by panel manufacturer, at end laps and side joints.

3.06 LOW-SLOPE APPLICATIONS

- A. Where roof slopes are less than 2:12 or roof system manufacturer's recommended minimum slope, conform to manufacturer's special recommendations for the assembly.

3.07 CLEANING

- A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.08 PROTECTION

- A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.
- B. Panels or flashings that have severe paint and/or substrate damage shall be replaced as directed by the Architect prior to date of Substantial Completion. Touch up paint is not acceptable.

END OF SECTION

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SECTION 07 41 14 - METAL ROOF PANELS - BOX RIB

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural roofing system of preformed steel panels.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 74 19 – Construction Waste Management and Disposal.
- C. Section 05 12 00 - Structural Steel Framing: Roof framing.
- D. Section 07 21 00 - Building Insulation: Rigid roof insulation.
- E. Section 07 62 00 - Sheet Metal Flashing and Trim: Sheet metal assemblies not associated with Metal Roof Panel systems.
- F. Section 07 92 00 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2021a.

1.04 SUBMITTALS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Summary of test results, indicating compliance with specified requirements.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Specimen warranty.

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- C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
 - 1. Show work to be field-fabricated or field-assembled.
- D. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.
 - 1. Include typical panel joint in sample.
- F. Test Reports: Indicate compliance of metal roofing system to specified requirements.
- G. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in District's name and are registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.
- B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.07 WARRANTY

- A. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of twenty years from Date of Substantial Completion.
- B. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of five years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design:

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1. Metal Roof Panels: AEP HR 36 manufactured by AEP Span.
- B. Other Acceptable Manufacturers; Metal Roof Panels:
 1. Berridge Manufacturing Company: www.berridge.com/#sle.
 2. Firestone Building Products LLC: www.firestonebpco.com/#sle.
 3. Morin Corporation: www.morincorp.com/#sle.
 4. The Garland Company Inc.: www.garlandco.com/products/metal

2.02 METAL ROOF PANELS

- A. Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.
- B. Metal Panels: Factory-formed panels with factory-applied finish.
 1. Steel Panels:
 - a. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; minimum AZ50 coating.
 - b. Steel Thickness: Minimum 18 gauge (0.0478 inch).
 2. Profile: Lapped seam, with exposed fastener system.
 - a. Rib depth: 1 1/2 inches.
 - b. Rib spacing: 7 1/2 inches maximum.
 3. Texture: Smooth.
 4. Length: Full length of roof slope, without lapped horizontal joints.
 5. Width: Maximum panel coverage of 36 inches.

2.03 ATTACHMENT SYSTEM

- A. Exposed System: Provide manufacturer's recommended stainless steel fasteners engineered to meet performance requirements and equipped with appropriate sealant separators to provide weathertight connections that will accommodate anticipated thermal movement.

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2.04 FABRICATION

- A. Panels: Provide factory fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.
- B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.05 FINISHES

- A. Exterior Finish:
 - 1. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat aluminum coil coating system complying with AAMA 2605,
 - 2. Primer: Baked-on 0.15-0.20 mil corrosion resistant primer.
 - 3. Finish Coat: Baked-on 0.70-0.80 mil finish coat with a specular gloss of 10-30% when tested in accordance with ASTM D-523 at 60°.
 - 4. Full 70% Kynar 500/Hylar 5000
 - 5. Color and as selected from manufacturer's standard range of not less than 16 non-metallic colors listed for compliance with State of California California Energy Commission requirements by the Cool Roof Rating Council (CRRC).
- B. Initial Solar Reflectance (SRI): Greater than 20 for nominally steep sloped roof >2:12.
- C. Interior Finish:
 - 1. Primer Coat Material: Corrosion-resistant primer; primer coat dry film thickness: 0.15 mils.
 - 2. Finish Coat material: polyester paint, finish coat dry film thickness: 0.35 mils.
 - 3. Color: Off-White to Light Gray

2.06 ACCESSORIES

- A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.
 - 1. Downspouts: Open face, rectangular profile.

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- B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of closed-cell synthetic rubber, neoprene, or PVC.
- C. Sealants:
 - 1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
 - 2. Concealed Sealant: Non-curing butyl sealant or tape sealant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation of preformed metal roof panels until supporting structure has been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.
- B. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.
- C. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

3.03 INSTALLATION

- A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
 - 1. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.
 - 2. Where openings exceed 6 inches in any direction: Shop fabricate and reinforce to maintain original load capacity.
- B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps,

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equipment curbs, rib closures, ridge closures, similar roof accessory items, and penetration flashing jacks.

- C. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.
 - 1. Provide sealant tape or other approved joint sealer at lapped panel joints.
 - 2. Install sealant or sealant tape, as recommended by panel manufacturer, at end laps and side joints.

3.04 CLEANING

- A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

- A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.
- B. Require workmen who will be walking on Roofing Panels to wear clean, soft-soled work shoes that will not pick up stones or other abrasive material, which could cause damage or discoloration.
- C. Panels or flashings that have severe paint and/or substrate damage shall be replaced as directed by the Architect prior to date of Substantial Completion. Touch up paint is not acceptable.

END OF SECTION

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SECTION 07 46 46 - FIBER-CEMENT PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiber-cement panels including exterior soffits.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 07 92 00 - Joint Sealants: Sealing joints between panels and adjacent construction and fixtures.
- C. Section 09 29 00 - Gypsum Board: Exterior gypsum sheathing.
- D. Section 09 90 00 - Painting: Field finishing.

1.03 REFERENCE STANDARDS

- A. ASTM C1186 - Standard Specification for Flat Fiber Cement Sheets 2008 (Reapproved 2016).

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's requirements for related materials to be installed by others.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods, including nail patterns.
- B. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.
- C. Test Report: Applicable model code authority evaluation report (e.g. ICC-ES).
- D. Installer's Qualification Statement.
- E. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.

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- F. Warranty: Submit copy of manufacturer's warranty, made out in District's name, showing that it has been registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products under waterproof cover and elevated above grade, on a flat surface.

1.06 WARRANTY

- A. Correct defective work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 FIBER-CEMENT PANELS

- A. Panel: Made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
1. Texture: Smooth.
 2. Length (Height): 96 inches, nominal.
 3. Width: 48 inches.
 4. Thickness: 5/16 inch, nominal.
 5. Finish: Unfinished.
 6. Warranty: 50 year limited; transferable.
 7. Manufacturers:
 - a. Allura, a division of Plycem USA, Inc: www.allurausa.com/#sle.
 - b. James Hardie Building Products, Inc: www.jameshardie.com/#sle.
 - c. Nichiha USA, Inc: www.nichiha.com/#sle.

2.02 ACCESSORIES

- A. Furring Strips: Galvanized metal channels.
- B. Fiber-Cement Trim: Same material and texture as soffit. Provide profiles and sizes as detailed.
- C. Fiber-Cement Siding Metal Trim: Extruded aluminum alloy 6063-T5 temper.

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1. Dimension and Layout: As indicated on drawings.
2. Finish: Powder coating.
 - a. Color: As selected by Architect.
- D. Fasteners: Galvanized or corrosion resistant; length as required to penetrate minimum 1-1/4 inch.
- E. Sealant: Elastomeric, polyurethane or silyl-terminated polyether/polyurethane, and capable of being painted.
- F. Finish Paint: Refer to Section 09 90 00 - Painting - for field finishing requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.
- B. Do not begin until unacceptable conditions have been corrected.
- C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and recommendations.
 1. Read warranty and comply with terms necessary to maintain warranty coverage.
 2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
 3. Use trim details indicated on drawings.
 4. Touch up field cut edges before installing.
 5. Pre-drill nail holes if necessary to prevent breakage.
- B. After installation, seal joints except lap joints of panels; seal around penetrations, and apply field finish to exposed cut edges.
- C. Finish Painting: Within one week after installation, finish panels and trim with one coat primer and two coats field applied finish.

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3.03 PROTECTION

- A. Protect installed products until Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

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SECTION 07 46 49 - POLY-ASH SIDING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Poly-ash siding and trim.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 07 27 26 - Sheet-Applied Membrane Air Barriers, Vapor Permeable: Membrane under siding.
- C. Section 07 46 46 - Fiber-Cement Panels: Soffit panels.
- D. Section 09 29 00 - Gypsum Board: Exterior gypsum sheathing.
- E. Section 09 90 00 - Painting: Field finishing poly-ash siding with semi-transparent stain.

1.03 REFERENCE STANDARDS

- A. American Wood Protection Association (AWPA) (www.awpa.com):
 - 1. AWPA E1 - Standard Method for Laboratory Evaluation to Determine Resistance to Subterranean Termites.
 - 2. AWPA E10 - Standard Method of Testing Wood Preservatives by Laboratory Soil-Block Cultures.
- B. ASTM International (ASTM) (www.astm.org):
 - 1. ASTM D 570 - Standard Test Method for Water Absorption of Plastics.
 - 2. ASTM D 1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
 - 3. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 - 4. ASTM D 6109 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber and Related Products.
 - 5. ASTM D 6341 - Standard Test Method for Determination of the Linear Coefficient of Thermal Expansion of Plastic Lumber and Plastic Lumber Shapes Between -30 and 140°F (-34.4 and 60°C).

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6. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. California Department of Forestry and Fire Protection (CAL FIRE) (www.fire.ca.gov):

1. Wildland-Urban Interface (WUI) CA SFM 12.7A-1 - Exterior Wall Siding and Sheathing.

D. Progressive Engineering Inc. (PEI) (www.p-e-i.com):

1. Pei Evaluation Service - Report PER-13069.

1.04 SUBMITTALS

A. Shop Drawings: P

1. Provide elevation of each wall to receive poly-ash siding. Indicate all door and window openings and show panel layout including location of all metal trims.

2. Provide details of intersections and conditions where siding adjoins door and window frames .

3. Provide typical details for wall penetrations and trim and flashings.

4. Minimize field cutting of poly-ash material.

B. Product Data: Submit manufacturer's product data, including installation instructions.

C. Samples: Submit manufacturer's sample of poly-ash siding.

1. Sample Size: Minimum 6 inches by 6 inches.

D. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

E. Test Reports: Submit manufacturer's test reports from testing performed by qualified, independent testing laboratories.

F. Product Evaluation Reports: Submit manufacturer's product evaluation reports from accredited, evaluation service.

G. Warranty Documentation: Submit manufacturer's standard warranty.

1.05 STORAGE AND HANDLING

A. Storage and Handling Requirements:

1. Store and handle materials in accordance with manufacturer's instructions.

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2. Store poly-ash siding on flat, level surface, raised above floor or ground, with adequate support to prevent sagging.
3. Keep poly-ash siding covered and free of dirt and debris until installation.
4. Protect materials and finish during storage, handling, and installation to prevent damage.

1.06 WARRANTY

- A. Warranty Period for Poly-Ash Siding: 20 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Boral Composites Inc., 200 Mansell Court East, Suite 305, Roswell, Georgia 30076. Toll Free 888-926-7259. Website www.boraltruexterior.com. E-mail info@truexterior.com.

2.02 POLY-ASH SIDING

- A. Poly-Ash Siding: "Boral TruExterior" siding. No Known Equal.
 1. "Nickel Gap" siding used as exterior wall covering over air barrier over plywood sheathing on wood stud framing.
 2. Material: Polymeric blend, fly ash, and glass fibers.
 3. Formed in continuous process, cut to 16-foot lengths, and milled to give a surface profile.
 4. Width: 5-1/2 inches.
 5. Nominal Thickness: 3/4 inch.
 6. Exposed Texture: Smooth.
- B. Listings and Reports:
 1. Cal Fire (WUI), CA SFM 12.7A-1: Listing No. 8140-2134:0103.
 2. Product Evaluation Report: Pei Evaluation Service, Report PER-13069.
- C. Recycled Content:
 1. Post-Industrial Recycled Content: Minimum 70 percent, by weight. 2. Post-Consumer Recycled Content: Minimum 2 percent, by weight.

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D. Properties:

1. Density, ASTM D 1622: 40 to 50 pcf.
2. Flexural Strength, ASTM D 6109: Greater than 1,600 psi.
3. Coefficient of Linear Expansion, ASTM D 6341: Less than 1.40 E-05 in/in/degree F.
4. Impact Resistance, ASTM D 1037: Greater than 50 inches.

E. Performance:

1. Fungi Rot, AWWA E10:
 - a. Brown Rot: Negligible loss.
 - b. White Rot: Negligible loss.
2. Termite Resistance, AWWA E1: Greater than 9.0 (10 being best).
3. Water Absorption, ASTM D 570: Less than 1.5 percent.
4. Surface Burning Characteristics, ASTM E 84:
 - a. Flame Spread Index: Less than 35.
 - b. Smoke Developed Index: Less than 450.

2.03 FABRICATION

A. Manufacturing Tolerances:

1. Width: Plus or minus 1/16 inch.
2. Thickness: Plus or minus 1/16 inch.
3. Length: Plus 2 inches, minus 0 inch.

B. Fabricate poly-ash slats for interior slatwall system to sizes and profiles indicated on drawings.

2.04 FINISHES

A. Primer:

1. Acrylic based.
2. Low VOC.

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3. Factory applied.

B. Finish: Refer to Section 09 90 00 - Painting for field-applied finish.

2.05 ACCESSORIES

A. Poly-Ash Trim:

1. Solid trim sizes and profiles fabricated from same material as siding.

B. Metal Trim:

1. Prefinished aluminum prepunched for fasteners; profiles and configurations as indicated on drawing details and as required for a complete installation.

a. Aluminum finish: High-performance organic coating; color to match aluminum storefront system specified in Section 08 43 13.

C. Fasteners:

1. Minimum 8d by 2-1/2-inch-long stainless steel ring-shank nails.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine wood framing members to receive poly-ash siding.

B. Notify Architect of conditions that would adversely affect installation.

C. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

A. Install poly-ash siding in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Do not install poly-ash siding in structural or load-bearing applications.

C. Use equipment and blade type recommended by the siding manufacturer for all field cutting. Use of circular saw or cut-off saw is not acceptable.

D. Install poly-ash siding plumb, level, square, and true to line.

E. Fastening: Install fasteners in accordance with local building code.

F. Painting:

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1. Apply topcoat of exterior semi-transparent stain over factory-applied primer:
 - a. Within 150 days of installing poly-ash siding.
 - b. As specified in Section 09 90 00 - Painting.
2. Ensure poly-ash siding is clean and dry before field finishing.

3.03 ADJUSTING

- A. Repair minor damages to poly-ash siding in accordance with manufacturer's instructions and as approved by Architect.
- B. Remove and replace with new material, damaged poly-ash siding that cannot be successfully repaired, as determined by Architect.

3.04 PROTECTION

- A. Protect installed poly-ash siding to ensure that, except for normal weathering, siding will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, and exterior penetrations not furnished as part of metal roofing systems.
- B. Galvanized metal wall covering panels.
- C. Exterior corner guards and wall end guards.
- D. Custom fabricated shelf units, soap shelves.
- E. Seismic joint flashing.
- F. Sealants for joints within sheet metal fabrications.
- G. Sheet metal splash pans.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 05 50 00 - Metal Fabrications: Downspout guards.
- C. Section 07 13 00 - Sheet Waterproofing: Below-grade waterproofing system.
- D. Section 07 27 26 - Sheet-Applied Membrane Air Barriers: Air barrier for exterior wall assemblies.
- E. Section 07 41 13 - Metal Roof Panels: Sheet metal provided in conjunction with metal roofing.
- F. Section 07 41 14 - Metal Roof Panels - Box Rib: Sheet metal provided in conjunction with box rib profile metal roofing.
- G. Section 07 92 00 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.
- H. Section 08 43 13 - Aluminum-Framed Storefronts: Storefront and entrance systems.
- I. Section 08 43 14 - Aluminum Thermal Sliding Doors.
- J. Section 08 62 00 - Unit Skylights: Integral metal curbs.

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- K. Section 09 30 00 -
Tiling: Cementitious backing units for exterior galvanized metal wall covering substrate.

1.03 REFERENCE STANDARDS

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- G. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- H. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing 2015a.
- I. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- J. CDA A4050 - Copper in Architecture - Handbook current edition.
- K. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. CALGreen Submittals: Provide the following:
 - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement

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of VOC content and chemical components.

2. Product Data for CALGreen 5.504.4.3 – Finish Material Pollutant Control; Architectural paints and coatings, including printed statement of VOC content and chemical components.
 3. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- B. Shop Drawings: Indicate material profiles, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples:
1. Pre-Finished Galvanized Steel: Submit two samples 6 inches by 6 inches inch in size illustrating metal finish color.
 2. Exposed Spangle Finish: Submit two samples 12 inches by 12 inches inch in size demonstrating Regular Spangle finish .

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Maintain one copy of each document on site.
- C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 GENERAL PRODUCT REQUIREMENTS

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials, Adhesives and Sealants.
- B. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials, Architectural Paints and Coatings including aerosol paint and coating systems.

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2.02 SHEET MATERIALS

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239 inch) thick base metal.
 - 1. Galvanized trim: Exterior exposed galvanized trim to be Large Spangle finish, typical.
- B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, 0.0239 inch thick base metal, shop pre-coated with PVDF coating.
 - 1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: To match metal roof panels as specified in Section 07 41 13 unless otherwise indicated..
- C. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; plain finish shop pre-coated with fluoropolymer coating.
 - 1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: To match aluminum storefront system specified in Section 08 43 13..
- D. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gauge, (0.0156 inch) thick; smooth No. 4 - Brushed finish.

2.03 FLASHING UNDERLAYMENT

- A. Sheet Membrane Underlayment at Flashings: Self-adhered, cold-applied composite rubberized asphalt sheet membrane consisting of rubberized asphalt bonded to a cross-laminated high-density polyethylene film with primers and seam sealers as required for a complete watertight installation; provide materials compliant with applicable regulations limiting VOCs.
 - 1. Under Sheet Metal and Flashing: Minimum 40-mil thick, high temperature self-adhering, polymer-modified, bituminous sheet membrane, complying with ASTM D1970, manufacturers and types as follows:
 - a. Basis-of-Design Product: The design for the system is based on the manufacturer identified below. Subject to compliance with requirements, provide the named product or a comparable product by the following:
 - b. Basis-of-Design Product: GCP Applied Technologies; Grace Ice and Water Shield HT.

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- c. Ensure named product is compatible with system provided under Section 07 27 26 - Sheet-Applied Membrane Air Barriers for a complete weathertight system.
- d. Ensure named product is compatible with underlayment specified in Section 07 41 13 - Metal Roof Panels - Standing Seam.

2.04 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet, interlocking with sheet.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- E. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- G. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- H. Fabricate flashings to allow toe to extend 2 inches over roofing surface. Return and brake edges.

2.05 GUTTER AND DOWNSPOUT FABRICATION

- A. Gutters: Profile as indicated.
- B. Downspouts: Rectangular profile.
- C. Gutters and Downspouts: Size indicated.
- D. Accessories: Profiled to suit gutters and downspouts.
 - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Brackets.
- E. Splash Pans: Same metal type as downspouts, formed to 12 by 18 inch size unless otherwise indicated; rolled sides of 1 inch high for inverted pan placement.
- F. Downspout Extenders: Same material and finish as downspouts.

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- G. Downspout Cleanouts: Rectangular section approximately 15 inches long with hinged cover, slotted leaf guard and retainer clip. Size, material and finish to match downspouts. KM Sheet Metal; www.kmsheetmetal.com. Provide one per downspout
- H. Seal metal joints.

2.06 SEISMIC JOINT FLASHING

- A. Preformed silicone and expanding foam composite bellows flashing:
 - 1. Pre-compressed UV resistant horizontal flashing: Sika Emseal Colorseal.
 - 2. Field-applied epoxy adhesive mounting.
 - 3. Color as selected from manufacturer's standard range to match metal roofing.

2.07 ACCESSORIES

- A. Fasteners: Stainless steel, with soft neoprene washers.
- B. Underlayment: ASTM D2178/D2178M, glass fiber roofing felt.
- C. Slip Sheet: Rosin sized building paper.
- D. Primer: Zinc chromate type.
- E. Concealed Sealants: Non-curing, non-skinning butyl sealant.
 - 1. Manufacturers:
 - a. Pecora Corporation; Pecora BA-98.
- F. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
 - 1. Manufacturers:
 - a. Franklin International, Inc; Titebond WeatherMaster Metal Roof Sealant: www.titebond.com/#sle.
- G. Plastic Cement: ASTM D4586/D4586M, Type I.
- H. Reglets: Surface mounted type, galvanized steel; face and ends covered with plastic tape.
- I. Pulls: Galvanized pulls for panel below exterior sink; approximately 4 inches long by 3/4 inch wide 16 gauge strap.

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- J. Weep Hole Vent Screens: Round aluminum louver with 20 gauge minimum aluminum screen infill and mill finished aluminum frame with retainer prongs. Maurice Franklin Louver Co. or equal. See drawings for size.

2.08 GALVANIZED METAL WALL COVERING PANELS

- A. Panel Covering: Galvanized steel sheet; 24 gauge.
- B. Panel Substrate: Cementitious backer board. Sawcut panels to required sizes.
- C. Fabricate panels with neatly formed return edges. Fit snugly over cementitious backing panels.

2.09 GALVANIZED CORNER AND WALL END GUARDS

- A. Guards: Galvanized steel sheet; 12 gauge.
- B. Fabricate guards with neatly formed return edges. Secure with exposed galvanized fasteners as indicated on drawing details.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 UNDERLAYMENT

- A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

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3.04 INSTALLATION

- A. Insert flashings into reglets to form tight fit; secure in place with plastic wedges; seal flashings into reglets with sealant.
- B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- E. Seal metal joints watertight.
- F. Secure gutters and downspouts in place with concealed fasteners.
- G. Set splash pans under downspouts at locations where downspouts are not terminated at storm drain.

3.05 EXTERIOR SHEET METAL WALL COVERING INSTALLATION

- A.
Install panels in accordance with drawing details. Align panels horizontally and set plumb for consistent vertical panel joint width.
- B. Space fasteners symmetrically, aligned horizontally, and install with neoprene washers.

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SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.
- D. Field quality control

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. A. Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- C. Section 07 27 26 - Sheet-Applied Membrane Air Barrier, Vapor Impermeable.
- D. Section 07 84 00 - Firestopping: Firestopping sealants.
- E. Section 08 11 13 - Hollow Metal Doors and Frames.
- F. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
- G. Section 08 80 00 - Glazing: Glazing sealants and accessories.
- H. Section 09 30 00 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.
- I. Division 32: Joints in pedestrian and vehicular pavement, curbs and gutters.

1.03 REFERENCE STANDARDS

- A. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants 2018.
- B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2019.
- C. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems 2016.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

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- E. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2018.
- F. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints 2019 (Reapproved 2020).

1.04 ACTION SUBMITTALS

- A. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.
 - 6. Substrates for which laboratory adhesion and/or compatibility testing is required.
 - 7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
 - 8. Sample product warranty.
 - 9. Certification by manufacturer indicating that product complies with specification requirements.
- B. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

1.05 INFORMATIONAL SUBMITTALS

- A. CALGreen Submittals: Provide product data to demonstrate that adhesives, sealants, and caulks used on the project meet the requirements of the following standards:
 - 1. TABLE 5.504.4.1 - ADHESIVE VOC LIMIT; TABLE 5.504.4.2 - SEALANT VOC LIMIT as listed in Section 01 81 13 - Sustainable Design Requirements.

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- B. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds (VOCs).
- C. Submit manufacturer's letter of certification that products comply with specified requirements and are suitable for the uses intended.
- D. Product Test Reports:
 - 1. Certified test results of elastomeric sealants showing compliance with specified requirements. Include results of aged performances including hardness, stain-resistance, adhesion and cohesion under cyclic movement, low temperature flexibility, modulus of elasticity at 100-percent strain, effects of heat and aging, and effects of accelerated weathering.
 - 2. Preconstruction field test results indicating which products and joint preparation methods demonstrated acceptable adhesion to joint substrates.
- E. Qualification Data: For Installer.

1.06 CLOSEOUT SUBMITTALS

- A. Warranties: Executed special warranties specified in this Section.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.
- C. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
 - 1. Adhesion Testing: In accordance with ASTM C794.
 - 2. Compatibility Testing: In accordance with ASTM C1087.
 - 3. Allow sufficient time for testing to avoid delaying the work.
 - 4. Deliver to manufacturer sufficient samples for testing.
 - 5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

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6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

D. Installation Plan: Include schedule of sealed joints, including the following.

1. Installation Log Form: Include the following data fields, with known information filled out.
 - a. Date of installation.
 - b. Name of installer.
 - c. Actual joint width; provide space to indicate maximum and minimum width.
 - d. Actual joint depth to face of backing material at centerline of joint.
 - e. Air temperature.

E. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.

1. Identification of testing agency.
2. Name(s) of sealant manufacturers' field representatives who will be observing
3. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
 - a. Test date.
 - b. Copy of test method documents.
 - c. Age of sealant upon date of testing.
 - d. Test results, modeled after the sample form in the test method document.
 - e. Indicate use of photographic record of test.

F. Field Adhesion Test Procedures:

1. Allow sealants to fully cure as recommended by manufacturer before testing.
2. Have a copy of the test method document available during tests.
3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.

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4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
 5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to District.
 6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.
- G. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.
1. Repair failed portions of joints.
- H. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
1. Sample: At least 18 inches long.
 2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
 3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.
 4. Repair failed portions of joints.

1.08 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.
- B. Exterior Sealants: Furnish a written warranty against leaks or other defects of materials and workmanship. Defects include but are not limited to changes in the structural, physical or chemical properties of the sealant materials that impair function or require abnormal maintenance, changes in surface finish, color or texture, failure in adhesion, weather resistance or durability, failure to prevent entry of water, or failure to comply with specified requirements.

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1. This warranty shall not cover formation of cracks or defects in substrate materials adjacent to the seal, joint movement in excess of movement rating of sealant, or physical damage caused by others.
 2. Repair or replace defective materials and workmanship during warranty period without expense to Owner, including removal and replacement of other items as required.
 3. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.
 4. Warranty Period: Ten years from date of Substantial Completion.
- C. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.
- D. Failure of the materials and workmanship include leakage, hardening, cracking, crumbling, melting, shrinkage or running of the sealant or caulking, or the staining of adjacent materials.
- E. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.01 SUSTAINABLE MATERIAL REQUIREMENTS, GENERAL

- A. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with the Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride,

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perchloroethylene, and trichloroethylene), except for aerosol products as specified in subsection 2, below.

- B. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.
- C. Refer to Section 01 81 13 - Sustainable Design Requirements for requirements for low-emitting materials.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.
 - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
 - 1) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
 - c. Other joints indicated below.
 - 3. Do not seal the following types of joints.
 - a. Intentional weepholes in concrete or masonry.

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- b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
- c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
- d. Joints where installation of sealant is specified in another section.
- e. Joints between suspended panel ceilings/grid and walls.

2.03 EXTERIOR JOINT SEALANTS

- A. Exterior Silicone Weatherproofing and Control Joint Sealant: ASTM C920, also ASTM C1193 and tested under ASTM C719; Type S, Grade NS, Class 100/50, Use NT, M, G, A, and O; single component, low-modulus, non-sag sealant, use at exterior joints in vertical surfaces and non-traffic horizontal surfaces.
 - 1. Acceptable Sealants:
 - a. Dow Corning Corporation; Dow Corning 790.
 - b. Pecora Corporation; 890.
 - c. Tremco; Spectrem 1.
- B. Reglets and Flashings Polyurethane Sealant: ASTM C920, polyurethane-based sealant; Type S, Grade NS, Class 100/50, and Use T, NT, G, and M; single component elastomeric. Use at exterior joints in horizontal walking surfaces.
 - 1. Acceptable Sealants:
 - a. Sika Corporation, Inc.; SikaFlex-15LM.
 - b. Tremco, Inc.; Vulkem 921.

2.04 INTERIOR JOINT SEALANTS

- A. Interior Weatherproofing and Control Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G, A, and O; single component, chemical curing, non-staining, non-bleeding, non-sagging type; color as selected; use in interior surfaces.
 - 1. Acceptable Sealants:
 - a. Pecora Corporation; Dynatrol I-XL.
 - b. Sika Corporation, Inc.; Sikaflex 1a.
 - c. BASF (Sonneborne); NP 1.

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- d. Tremco; Dymonic FC.
- B. Wood Panel Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, O; single-component urethane, color to be selected.
1. Acceptable Sealants:
 - a. Sika Corporation, Inc.; Sikaflex 1a Construction Sealant.
 - b. BASF (Sonneborn); Sonolastic NP-1.
 - c. Tremco, Inc.; Vulkem 116.
- C. Interior Latex Joint Sealant: Provide product complying with ASTM C834, Type S, Use O, Grade NS; use at interior joints in vertical surfaces and non-traffic horizontal surfaces.
1. Acceptable Sealants:
 - a. Pecora Corporation; AC-20.
 - b. BASF (Sonneborn); Sonolac.
 - c. Tremco; Tremflex 834.
- D. Mildew Resistant Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25; Use NT, G, A, and O; use on non-porous interior surfaces under high humidity and temperature extremes. For use in bathrooms, spas, and similar applications where joints need protection against fungi and bacteria.
1. Acceptable Sealants:
 - a. Dow Corning Corporation; Dow Corning 786.
 - b. Pecora, Inc. 898.
 - c. Tremco, Inc Tremsil 200.
- E. Interior Food Contact Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, G, A, and O; USDA compliant.
1. Joints in kitchen countertops and work surfaces.
 2. Joints between food service equipment and surrounding construction.
 3. Other interior joints where incidental food contact may occur.
 4. Acceptable Sealants:

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- a. Pecora Corporation; 898.
 - b. BASF (Sonneborn); Omniplus.
- F. Acoustical Sealant for Exposed and Concealed Joints: Non-sag, paintable, nonstaining, latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90; use for drywall or plaster wall systems, bedding electrical boxes and other wall outlets.
- 1. Acceptable Sealants: One of the following or approved equal:
 - a. Pecora Corporation; AIS 919 Acoustical and Insulation Latex Sealant.
 - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
 - c. Tremco, Inc.; Tremflex 834 or Tremco Acoustical Sealant.

2.05 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 - 1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
 - 2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
 - 3. Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Outlet Box Sealant: Resilient sealer pads; use to seal back and sides of all junction boxes recessed in acoustically-rated partitions.
 - 1. Fire-Rated Partitions: Hevi-Duty Nelson FSP Firestop Putty Pads, or equal (no known equal)
 - 2. Non-Fire-Rated Partitions: Lowry's Outlet Box Pad, or equal (no known equal).

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- E. Compressible Tape: 1/4-inch-thick, double-sided, closed-cell foam tape; use to seal interior partitions to window mullions.
 - 1. Norseal V988, 3M 4992, or equal
- F. Foam Sealing Tape:
 - 1. General: Open-cell, flexible, polyurethane foam impregnated with synthetic resin and developed to expand into openings and create seals which are airtight, thermally efficient, and vapor permeable.
 - 2. Applications: Door and window shim spaces at heads and jambs, and elsewhere as indicated.
 - 3. Basis-of-Design Product: Tremco Incorporated; ExoAir Trio.
 - 4. Tape Width: As required for intended applications.
- G. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- H. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.
- D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
 - 1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
 - 2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
 - 3. Arrange for sealant manufacturer's technical representative to be present during tests.
 - 4. Record each test on Preinstallation Adhesion Test Log as indicated.
 - 5. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.

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6. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
 1. Width/depth ratio of 2:1.
 2. Neck dimension no greater than 1/3 of the joint width.
 3. Surface bond area on each side not less than 75 percent of joint width.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

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3.04 FIELD QUALITY CONTROL

- A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.
- C. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet, notify Architect immediately.
- D. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.
- E. Repair destructive test location damage immediately after evaluation and recording of results.

3.05 CLEANING

- A. Construction Waste Management: Manage construction waste in accordance with provisions of Section 01 74 19 Construction Waste Management and Disposal. Submit documentation for CALGreen compliance in accordance with Division 1 Sustainable Design Requirements.

3.06 POST-OCCUPANCY

- A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

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SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Hollow metal frames for fiberglass doors.
- D. hollow metal frames for sectional doors.
- E. Hollow metal borrowed lites glazing frames.
- F. Accessories, including glazing, louvers, and matching panels.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- C. Section 08 14 16 - Flush Wood Doors
- D. Section 08 16 13 - Fiberglass Doors.
- E. Section 08 36 13 - Sectional Doors.
- F. Section 08 71 00 - Door Hardware.
- G. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.
- H. Section 09 90 00 - Painting.

1.03 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.
- B. HMMA: Hollow Metal Manufacturers Association.
- C. NAAMM: National Association of Architectural Metal Manufacturers.
- D. NFPA: National Fire Protection Association.

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E. SDI: Steel Door Institute.

F. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2011.
- C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames 2003 (R2009).
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
- E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2011.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2020.
- H. ASTM A1011/A1011M - 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 2018a.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- J. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2016.
- K. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.
- M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.
- N. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2007.

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- O. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.
- P. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2013.

1.05 SUBMITTALS

- A. CALGreen Submittals: Provide the following:
 - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
 - 2. Product Data for CALGreen 5.504.4.3 – Finish Material Pollutant Control; Architectural paints and coatings, including printed statement of VOC content and chemical components.
 - 3. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- F. Manufacturer's Qualification Statement.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: www.steeldoor.org/sdicertified.php/#sle.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:

1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
4. Steelcraft, an Allegion brand: www.allegion.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
4. Door Edge Profile: Manufacturers standard for application indicated.
5. Typical Door Face Sheets: Flush.
6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - a. Based on SDI Standards: Provide at least A40/ZF120 (galvanized) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvanized) for corrosive locations.

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- B. Hollow Metal Panels: Same construction, performance, and finish as doors.
- C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Thermally insulated.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
 - e. Zinc Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.
 - 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 - a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
 - 3. Door Thickness: 1-3/4 inches, nominal.
 - 4. Top Closures for Outswinging Doors: Flush with top of faces and edges.
 - 5. Weatherstripping: Refer to Section 08 71 00.
 - 6. Door Finish: Factory primed and field finished.
- C. Interior Doors, Non-Fire-Rated:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

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- a. Level 2 - Heavy-duty.
 - b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
 - e. Zinc Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.
2. Door Thickness: 1-3/4 inches, nominal.
 3. Door Face Sheets: Flush.
 4. Door Finish: Factory primed and field finished.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Exterior Door Frames: Full profile/continuously welded type.
 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvanized) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
 3. Frame Finish: Factory primed and field finished.
 4. Weatherstripping: Separate, see Section 08 71 00.
- D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 1. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch, maximum, above floor at 45 degree angle.
 2. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
 3. Frame Finish: Factory primed and field finished.
- E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

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- F. Mullions for Pairs of Doors: Profile similar to jambs except where removable mullion is specified..
- G. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- H. Transom Bars: Fixed, of profile same as jamb and head.
- I. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 FINISHES

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for requirements for low-emitting materials, Architectural Paints and Coatings including aerosol paint and coating systems.
- B. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- C. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.06 ACCESSORIES

- A. Louvers: Roll formed steel with overlapping frame; finish same as door components ; factory-installed.
 - 1. Fasteners: Concealed fasteners.
 - 2. Louver Screens: Metal-framed noncombustible mesh screen; 1/8 inch x 1/8 inch maximum opening size.
- B. Door Window Frames: Door window frames with glazing securely fastened within door opening.
 - 1. Size: As indicated on drawings.
 - 2. Frame Material: 18 gage, 0.0478 inch, galvanized steel, with finish to match door.
 - 3. Metal Finish: Beige polyester powder coating.
 - 4. Glazing: 1/4 inch thick, tempered glass, in compliance with requirements of authorities having jurisdiction. Provide fire rated glazing at labeled doors.
- C. Glazing: As specified in Section 08 80 00, factory installed.

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- D. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered corners; prepared for countersink style tamper proof screws.
- E. Astragals and Edges for Double Doors: Pairs of door astragals, and door edge sealing and protection devices.
 - 1. UL listed products in compliance with requirements of authorities having jurisdiction.
 - 2. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
 - 3. Astragal Type: Overlapping, T-shaped, with coordinator for proper door closing sequence, and with automatic locking, cutouts for other door hardware, and sealing gasket.
 - 4. Edge Type: Beveled edge
 - 5. Material: Aluminum.
 - 6. Provide non-corroding fasteners at exterior locations.
- F. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
- G. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- H. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Install door hardware as specified in Section 08 71 00.

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1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
- D. Comply with glazing installation requirements of Section 08 80 00.
- E. Coordinate installation of electrical connections to electrical hardware items.
- F. Touch up damaged factory finishes.

3.03 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.04 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.05 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

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SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush and flush glazed configuration; non-rated.
- B. Transom panels.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 81 13 - Sustainable Design Requirements: Requirements for certified wood and low-emitting materials.
- C. Section 08 11 13 - Hollow Metal Doors and Frames.
- D. Section 08 71 00 - Door Hardware.
- E. Section 08 80 00 - Glazing.
- F. Section 09 90 00 - Painting: Field finishing of doors indicated to receive opaque finish.

1.03 REFERENCE STANDARDS

- A. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- B. AWI (QCP) - Quality Certification Program Current Edition.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2018).
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2017, with Errata (2019).
- E. UL (DIR) - Online Certifications Directory Current Edition.
- F. WI (CCP) - Certified Compliance Program (CCP) Current Edition.

1.04 SUBMITTALS

- A. CALGreen Submittals: Provide the following:
 - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement

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of VOC content and chemical components.

2. Product Data for CALGreen 5.504.4.3 – Finish Material Pollutant Control; Architectural paints and coatings, including printed statement of VOC content and chemical components.
 3. Product Data for CALGreen 5.504.4.5 – Composite Wood Products: For composite-wood products, showing requirements for formaldehyde as specified in Table 5.504.4.
 4. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for certified wood and low-emitting materials.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
 2. Include certification program label.
- D. Samples: Submit two samples of door construction, 6 by 6 inches in size cut from top corner of door.
- E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- F. Manufacturer's Installation Instructions: Indicate special installation instructions.
- G. Manufacturer's Qualification Statement.
- H. Specimen warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Forest Stewardship Council (FSC) Certified Products:
1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

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2. Forest Certification: Provide components made with not less than 50 percent of wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

C. Quality Certification:

1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
2. Comply with WI (CCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.woodworkinstitute.com/#sle.
3. Provide labels or certificates indicating that installed work will comply with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
4. Provide designated labels on shop drawings as required by certification program.
5. Provide designated labels on installed products as required by certification program.
6. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY

- A. General Warranty: Door manufacturer's warranty specified in this Article shall not deprive the District of other rights the District may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents
- B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4-inch in a 42 inch by 84 inch section or that show telegraphing of core construction in face veneers exceeding 0.01-inch in a 3 inch span, or do not conform to tolerance limitations of referenced quality

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standards.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.
2. Warranty shall be in effect during the following period of time after date of Final Completion.
 - a. Solid Core Interior Doors: Life of installation.

PART 2 PRODUCTS

2.01 SUSTAINABLE DESIGN REQUIREMENTS

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for requirements for low-emitting materials, Adhesives and Sealants.
- B. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for requirements for low-emitting materials, Composite Wood Products.
- C. Certified Wood: Wood doors shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.

2.02 MANUFACTURERS

- A. Medium-Density Overlay (MDO) Faced Doors for Opaque Finish:
 1. Masonite Architectural: www.architectural.masonite.com/#sle.
 2. Oregon Door: www.oregondoor.com/#sle.
 3. VT Industries, Inc[<>]: www.vtindustries.com/#sle.

2.03 DOORS

- A. Doors: See drawings for locations and additional requirements.
 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 1. Provide solid core doors at each location.
 2. MDO veneer facing with factory primed finish.
 - a. Provide units pre-primed with door manufacturer's recommended primer conforming to specified VOC limits and compatible with field-applied opaque finish

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specified in Section 09 90 00 - Painting.

2.04 DOOR AND PANEL CORES

- A. Non-Rated Solid Core Doors: Staved Lumber Core or structural composite lumber core (SCLC). Five Plies; stiles and rails bonded to core. Entire unit abrasive planed before veneering.

2.05 DOOR FACINGS

- A. Veneer Facing for Opaque Finish: Medium density overlay (MDO), in compliance with indicated quality standard.
- B. Facing Adhesive: Type I - waterproof.

2.06 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge for hardware reinforcement.
 - 2. Provide solid blocking for other throughbolted hardware and all closer locations.
- C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
- D. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
 - 1. Exception: Doors to be field finished.
- G. Provide edge clearances in accordance with the quality standard specified.

2.07 FINISHES - WOOD VENEER DOORS

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for requirements for low-emitting materials, Architectural Paints and Coatings including aerosol paint and coating systems.

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- B. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
- C. Seal door top edge with sealer to match door facing.
- D. Field finish doors indicated to receive opaque finish in accordance with requirements of Section 09 90 00 - Painting.

2.08 ACCESSORIES

- A. Hollow Metal Door Frames: See Section 08 11 13.
- B. Metal Louvers:
 - 1. Material and Finish: Roll formed steel; pre-painted finish to color as selected.
 - 2. Louver Blade: Inverted V blade, sight proof, light proof; fire rated to [] hours with fusible link design to UL (DIR) requirements.
 - 3. Louver Free Area: 50 percent.
 - 4. Frame: square profile style with tamper proof fasteners.
- C. Glazed Openings:
 - 1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048.
- D. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- E. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Field-Finished Doors: Trimming to fit is acceptable.

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1. Adjust width of non-rated doors by cutting equally on both jamb edges.
 2. Trim maximum of 3/4 inch off bottom edges.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.
- F. Install door louvers plumb and level.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

3.05 SCHEDULE

- A. Refer to Door and Frame Schedule on drawings.

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SECTION 08 16 13 - FIBERGLASS DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Composite fiberglass doors.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 08 11 13 - Hollow Metal Doors and Frames: Frames for fiberglass doors.
- C. Section 08 43 13 - Aluminum-Framed Storefronts
- D. Section 08 71 00 - Door Hardware.
- E. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

- A. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections 2009.
- B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2010 (Reapproved 2018).
- C. ASTM D570 - Standard Test Method for Water Absorption of Plastics 1998 (Reapproved 2018).
- D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position 2018.
- E. ASTM D638 - Standard Test Method for Tensile Properties of Plastics 2014.
- F. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials 2017.
- G. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor 2013a.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

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- J. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).
- K. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).
- L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).
- M. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights 2019c.
- N. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2017.

1.04 SUBMITTALS

- A. See Division 1 for submittal procedures.
- B. Product Data: Provide manufacturer's standard details, installation instructions, hardware and anchor recommendations.
- C. Shop Drawings: Indicate layout and profiles; include assembly methods.
 - 1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.
 - 2. Indicate wall conditions, door and frame elevations, sections, materials, gauges, finishes, location of door hardware by dimension, and details of openings; use same reference numbers indicated on drawings to identify details and openings.
- D. Submit manufacturer's door sample composed of door face sheet, core, framing and finish.
- E. Selection Samples: Submit door surface samples for each finish specified, 10 inches by 10 inches in size, illustrating finishes, colors, and textures.
- F. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.
- I. Maintenance Data: Include instructions for repair of minor scratches and damage.

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- J. Warranty: Submit manufacturer warranty and ensure that forms have been completed in District's name and registered with manufacturer; include detailed terms of warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than 25 years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- C. Provide evidence of a Manufacturer's documented complaint resolution quality management system.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Mark doors with location of installation, door type, color, and weight.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Store materials in original packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.
 - 1. Store at temperature and humidity conditions recommended by manufacturer.
 - 2. Do not use non-vented plastic or canvas shelters.
 - 3. Immediately remove wet wrappers.
- D. Store in position recommended by manufacturer, elevated minimum 4 inches above grade, with minimum 1/4 inch space between doors.

1.07 FIELD CONDITIONS

- A. Do not install doors until structure is enclosed.
- B. Maintain temperature and humidity at manufacturer's recommended levels during and after installation of doors.

1.08 WARRANTY

- A. See Division 1 for additional warranty requirements.
- B. Provide ten (10) year manufacturer warranty covering materials and workmanship .
- C. Limited Lifetime Warranty:

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1. In addition to Standard Warranty, provide Limited Lifetime warranty that covers failure of corner joinery, core deterioration, and delamination or bubbling of door skin and corrosion of all-fiberglass products while the door is in its specified application in its original installation.

D. Finish Warranty: 3 years

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Smooth Composite Fiberglass (FRP) Doors with Expanded Polystyrene Core.:

1. Special-Lite, Inc; AF-200: www.special-lite.com/#sle.

2.02 DOOR ASSEMBLIES

A. Door Assemblies: Factory-fabricated, prepared and machined for hardware.

1. Screw-Holding Capacity: Tested to 890 pounds, minimum.
2. Surface Burning Characteristics: Flame spread index (FSI) of 0 to 25, Class A, and smoke developed index (SDI) of 450 or less, when tested in accordance with ASTM E84.
3. Flammability: Self-extinguishing when tested in accordance with ASTM D635.
4. Sizes: As indicated on drawings.
5. Clearance Between Door and Frame: 1/8 inch, maximum.
6. Clearance Between Bottom of Door and Finished Floor: 3/4 inch, maximum; not less than 1/4 inch clearance to threshold.

2.03 COMPONENTS

A. Doors: Fiberglass construction with reinforced core.

1. Thickness: 1-3/4 inch, nominal.
2. Core Material: Expanded polystyrene foam (EPS) 2.0 pcf.
3. Construction:
 - a. Stiles and rails: Pultruded fiberglass with integral channels for securing corner reinforcing clip.

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- b. Corners: Mitered and secured with pultruded fiberglass corner clip chemically welded to stiles and rails.
 - c. Mechanical fasteners to secure corner joints not acceptable.
- 4. Door Panel: Flush door.
- 5. Subframe and Reinforcements:
 - a. Solid high-density polyurethane shapes chemically welded to stiles, rails and/ or core.
 - b. No metallic reinforcements will be allowed.
- 6. Fiberglass face sheets, 0.090" thick, Class C, smooth texture, painted FRP sheet.
 - a. Face sheets to be flame treated.
 - b. Face sheets adhered to stiles, rails, and core using hot melt adhesive evenly coated across all surfaces to produce strong bond and prevent moisture absorption.
 - c. Face Sheet Texture: Smooth.
- 7. Waterproof Integrity: Provide factory fabricated edges, cut-outs, and hardware preparations of fiberglass reinforced plastic (FRP); provide cut-outs with joints sealed independently of glazing, louver inserts, or trim.
- 8. Hardware Preparations: Factory reinforce, machine, and prepare for door hardware including field installed items; provide solid blocking for each item; field cutting, drilling or tapping is not permitted; obtain manufacturer's hardware templates for preparation as necessary.

B. Hollow Metal Frames: See Section 08 11 13 Hollow Metal Doors and Frames.

2.04 PERFORMANCE REQUIREMENTS

- A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.
- B. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 7.5 psf.
- C. Air Leakage: Maximum of 0.06 cfm per square foot at 6.24 psf differential pressure, when tested in accordance with ASTM E283.

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- D. Structural Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
- E. Thermal Transmittance, Exterior Doors: NFRC 100, U-value of 0.24, maximum, measured on exterior door in size required for this project.
- F. Acoustical Performance: Sound Transmission Class (STC) of 30, minimum, when tested in accordance with ASTM E90.
- G. Fiberglass Reinforced Plastic (FRP) Face Sheet Properties:
 - 1. Izod Impact Resistance: ASTM D256, 5.0 foot-pound force per inch of width, minimum, with notched izod.
 - 2. Tensile Strength at Break: ASTM D638, 6000 psi, minimum.
 - 3. Water Absorption: ASTM D570, 0.16 percent, maximum, after 24 hours at 77 degrees F.
 - 4. Flexural Strength: ASTM D790, 14,000 psi, minimum.
 - 5. Barcol Hardness: ASTM D2583, minimum of 35 units.

2.05 FINISHES

- A. Painted: Two-part aliphatic polyurethane, low VOC industrial coating.
 - 1. Thickness: Minimum 5 mils, 0.005 inch wet thickness.
 - 2. Colors: As selected by Architect from manufacturer's custom line of colors.
 - a. Provide doors split-finished with one color for interior and one color for exterior face.
 - 3. High-solids, high-build, self-priming formulation.
 - 4. Impact Resistance, ASTM-D2794: 140 in-lbs (direct), 50 in-lbs (reverse) for 5 mils thickness.
 - 5. Taber Abrasion, 1 kg load, 1000 cycles, CS-17 wheel: 60.2 mg.
 - 6. Graffiti cleaning with Amerase with gloss retention: 100 cycles.

2.06 ACCESSORIES

- A. Stops for Glazing and Louver: Fiberglass, unless otherwise indicated or required by fire rating; provided by door manufacturer to fit factory made openings, with color and texture to

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match door; fasteners shall maintain waterproof integrity.

1. Exterior Doors: Provide non-removable stops on exterior side with continuous compression gasket weatherseal.
 2. Glazed Openings: Provide removable stops on interior side.
 3. Opening Sizes and Shapes: As indicated on drawings.
- B. Glazing: See Section 08 80 00.
- C. Louvers for Non-Fire-Rated Doors: Same materials, construction, finish, and color as door; fixed vanes, 45 degree sloped vanes.
1. Insect Screens: Incombustible metal mesh; 1/8 inch x 1/8 inch mesh.
- D. Door Hardware: See Section 08 71 00.
- E. Fasteners
1. All exposed fasteners to have a finish to match material being fastened.
 2. 410 stainless steel or other non-corrosive metal.
 3. Must be compatible with items being fastened.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify actual dimensions of openings by field measurements before door fabrication; show recorded measurements on shop drawings.
- B. Do not begin installation until substrates have been properly prepared.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- B. Clean and prepare substrate in accordance with manufacturer's directions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions; do not penetrate frames with anchors.

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- B. Install exterior doors in accordance with ASTM E2112.
- C. Install door hardware as specified in Section 08 71 00.
- D. Set units plumb, level, and true-to-line, without warping or racking doors, and with specified clearances; anchor in place.
- E. Separate aluminum and other metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials.
- F. Repair or replace damaged installed products.

3.04 ADJUSTING

- A. Lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion, and to fit watertight for entire perimeter.
- B. Adjust hardware for smooth and quiet operation.
- C. Adjust doors to fit snugly and close without sticking or binding.

3.05 CLEANING

- A. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.

3.06 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

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SECTION 08 31 00 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall and ceiling mounted access units.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 08 71 00 - Door Hardware: Mortise cylinder and core hardware.
- C. Section 09 90 00 - Painting: Field paint finish
- D. Divisions 21 through 26: Fire Protection, Plumbing, Mechanical and Electrical components requiring access.
- E. Division 23: Air duct accessories including access doors in ductwork.

1.03 REFERENCE STANDARDS

- A. ITS (DIR) - Directory of Listed Products current edition.
- B. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

- A. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- B. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- C. Project Record Documents: Record actual locations of each access unit.

PART 2 PRODUCTS

2.01 WALL AND CEILING MOUNTED ACCESS UNITS

- A. Manufacturers:
 - 1. Babcock-Davis: www.babcockdavis.com/#sle.
 - 2. Karp Associates, Inc: www.karpinc.com/#sle.
 - 3. Milcor, Inc: www.milcorinc.com/#sle.

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4. Nystrom, Inc: www.nystrom.com/#sle.

B. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.

1. Material: Steel.

2. Style: Recessed door panel for infill with wall/ceiling finish.

a. Gypsum Board Mounting Criteria: Use drywall bead type frame.

3. Frames: 16 gauge, 0.0598 inch, minimum thickness.

4. Door Panels to Receive Wall/Ceiling Finish: Surface recessed 5/8 inch back from wall face.

5. Insulation: Non-combustible mineral wool or glass fiber.

6. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.

a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.

7. Steel Finish: Primed.

8. Hardware:

a. Hardware for Fire-Rated Units: As required for listing.

b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.

c. Latch/Lock: Tamperproof tool-operated cam latch.

d. Latch/Lock: Cylinder lock-operated cam latch, two keys for each unit.

1) Mortise cylinder and core as specified in Section 08 71 00.

e. Number of Locks/Latches Required: As recommended by manufacturer for size of unit.

f. Inside Latch Release: Mechanism that allows door/panel to be opened from inside.

g. Gasketing: Extruded neoprene, around perimeter of door panel.

C. Wall-Mounted Units in Wet Areas and all areas with ceramic tile wall finish:

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1. Locations and sizes as indicated on the drawings. Minimum sizes as required by code for the component to be accessed.
2. Location: As indicated on drawings.
3. Panel Material: Stainless steel, Type 304.
4. Size: 12 by 12 inches, minimum.
5. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
6. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

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SECTION 08 36 13 - SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Overhead sectional doors, electrically operated.
- B. Operating hardware and supports.
- C. Electrical controls.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 05 12 00 - Structural Steel Framing.
- C. Section 05 50 00 - Metal Fabrications: Steel channel opening frame.
- D. Section 06 10 00 - Rough Carpentry: Rough wood framing for door opening.
- E. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- F. Section 08 80 00 - Glazing.
- G. Division 26 - Electrical conduit, wiring and connections.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- B. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).
- C. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).
- D. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors 2011.
- E. ITS (DIR) - Directory of Listed Products current edition.

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- F. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2000, with Errata (2008).
- G. NEMA MG 1 - Motors and Generators 2018.
- H. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL (DIR) - Online Certifications Directory Current Edition.
- K. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Refer to Division 1, for submittal procedures.
- B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- C. Product Data: Show component construction, anchorage method, and hardware.
- D. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
- E. Operation Data: Include normal operation, troubleshooting, and adjusting.
- F. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.
- C. Comply with applicable code for motor and motor control requirements.
- D. Products Requiring Electrical Connection: Listed and classified by ITS (DIR) or UL (DIR), as suitable for purpose specified.

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1.06 WARRANTY

- A. Correct defective Work within a 5 year period after Date of Substantial Completion.
- B. Warranty: Include coverage for electric motor and transmission.
- C. Provide 5 year manufacturer warranty for electric operating equipment.
- D. Provide a special 20-year warranty for high performance finish coating.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Clopay Model 3728 commercial duty insulated full-view doors, manufactured by Clopay Building Products.
- B. Other Acceptable Manufacturers - Sectional Doors:
 - 1. C.H.I. Overhead Doors: www.chiohd.com/#sle.

2.02 STEEL DOORS

- A. Steel Doors: Flush steel, insulated; high lift operating style with track and hardware; complying with DASMA 102, Commercial application.
 - 1. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
 - 2. Door Nominal Thickness: 2 inches thick.
 - 3. Thermal Resistance (R-value): 18.4 deg F hr sq ft/Btu (3.0 (K sq m)/W); calculated door section R-value in accordance with DASMA TDS-163.
 - 4. Air Leakage Rate: Less than 0.40 cfm/sf when tested in accordance with ASTM E283 at test pressure difference of 1.57 psf.
 - 5. Exterior and Interior Finish: Factory finished with solar-reflective 2-part polyurethane enamel finish; color as selected by Architect to match Aluminum Storefront.
 - 6. Glazed Lights: 2 glazed lights per panel, multi- row as indicated; set in place with resilient glazing channel.
 - 7. Electric Operation: Electric control station. Jamb-mounted.
- B. Door Panels: Steel construction; outer steel sheet of 27 gauge, 0.0164 inch minimum thickness, flush flush profile; inner steel sheet of 27 gauge, 0.0164 inch minimum thickness,

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flat flat profile; core reinforcement sheet steel roll formed to channel channel shape, rabbeted weather joints at meeting rails; foamed-in-place polyurethane polyurethane insulation.

- C. Window Frame: Manufacturers standard, finish to match door panels.
- D. Glazing: Fully tempered glass; insulated glass units; obscure; 3/4 inch overall thickness.

2.03 COMPONENTS

- A. Track: Rolled galvanized steel, profile and width as required for door sizes indicated, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.
- B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.
- C. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.
- D. Sill Weatherstripping: Resilient hollow neoprene strip, one piece; fitted to bottom of door panel, full length contact.
- E. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.
- F. Head Weatherstripping: EPDM rubber seal, one piece full length.
- G. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.
- H. Lock: Inside center mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.
- I. Lock Cylinders: See Section 08 71 00.

2.04 MATERIALS

- A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.
- B. Glazing: Refer to Section 08 80 00 - Glazing.
- C. Insulation: CFC- and HCF-free Foamed-in-place polyurethane, bonded to facing.
 - 1. R-value of 18.4.
- D. Finish System:

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1. Conform to American Architectural Manufacturing Association (AAMA) 2604 standards.
2. Surface Preparation: The substrate shall be thoroughly cleaned using a multi-stage cleaning process to remove organic and inorganic surface soils and residual oxides. Apply a chemical conversion coating to which organic coatings will firmly adhere.
3. Finish System: Primer and two-part polyurethane-based commercial paint formulated for excellent adhesion and stability providing a high quality, durable and professional finish.
 - a. Sherwin-Williams Solar Reflective Polane Polyurethane Enamel. Color to match Aluminum Storefront.

2.05 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR) or UL (DIR).
 1. Provide interlock switches on motor operated units.
- B. Electric Operators:
 1. Mounting: Side mounted on cross head shaft.
 2. Motor Enclosure:
 - a. Exterior Doors: NEMA MG 1, Type 4; open drip proof.
 3. Motor Rating: 1/2 hp; continuous duty.
 4. Motor Voltage: 120 volts, single phase, 60 Hz.
 5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
 6. Controller Enclosure: NEMA 250, Type 1.
 7. Opening Speed: 12 inches per second.
 8. Brake: Adjustable friction clutch type, activated by motor controller.
 9. Manual override in case of power failure.
 10. Refer to Division 26 for electrical connections.
- C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.

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- D. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.
1. 24 volt circuit.
 2. Recess mounted, at interior door jamb.
 3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.
- E. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow neoprene covered to provide weatherstrip seal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

3.03 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.
- E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.
- F. Install perimeter trim and closures.

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3.04 TOLERANCES

- A. Maximum Variation from Plumb: 1/16 inch.
- B. Maximum Variation from Level: 1/16 inch.
- C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.
- D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.
- B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

3.06 CLEANING

- A. Clean doors and frames and glazing.
- B. Remove temporary labels and visible markings.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

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SECTION 08 43 13 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Infill panels of metal and glass.
- C. Venting windows.
- D. Electrically-operated window control systems.
- E. Aluminum doors and frames.
- F. Aluminum doors and frames at greenhouses.
- G. Weatherstripping.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 07 27 26 - Sheet-Applied Membrane Air Barriers, Vapor Impermeable
- C. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- D. Section 08 43 14 - Aluminum Thermal Sliding Doors.
- E. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.
- F. Section 08 80 00 - Glazing: Glass and glazing accessories.
- G. Section 12 21 13 - Horizontal Louver Blinds: Attachments to framing members.
- H. Section 12 24 00 - Window Shades: Attachments to framing members.
- I. Section 13 34 13 - Greenhouses
- J. Division 26: Power for electrically-operated window control systems.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site 2015.

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- B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems 2015.
- C. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems 2014.
- D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.
- E. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).
- F. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- G. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- H. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- I. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- J. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- K. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- L. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- M. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.
- N. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.
- O. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.
- P. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

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2014.

- Q. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).
- R. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors 2002 (Reapproved 2018).
- S. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015.
- T. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
- B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- C. Samples: Submit two samples minimum 12 x 12 inches in size illustrating finished aluminum surface, glass, infill panels, glazing materials.
- D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- E. Certificate of NFRC Compliance and test report including center-of-glass U value and corresponding overall U value.
- F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- H. Manufacturer's Qualification Statement.

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- I. Warranty: Submit manufacturer warranty and ensure forms have been completed in District's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
 - a. Insulating Glass Certification Council (IGCC).
 - b. Safety Glazing Certification Council (SGCC).
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
 1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.
 - a. North American Contractor Certification (NACC) for glazing contractors.
 - b. Equivalent independent third-party ANSI accredited certification.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

- A. Correct defective Work within a five year period after Date of Substantial Completion.
- B. Provide 10 year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- C. Special Finish Warranty for High-Performance Organic Coatings: Provide 20 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

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- D. Provide two-year manufacturer warranty on window operators and control systems.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Kawneer North America www.kawneer.com/#sle.
- B. Other Acceptable - Aluminum-Framed Storefronts Manufacturers, subject to compatibility with configurations shown in the drawings:
1. Arcadia, Inc: www.arcadiainc.com/#sle.
 2. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com/#sle.
 3. Oldcastle BuildingEnvelope: www.oldcastlebe.com/#sle.
- C. Storefronts, entrances, and venting windows shall all be products of the Storefront Manufacturer and shall be designed for compatibility and consistent performance characteristics.

2.02 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices, thermally broken with interior section insulated from exterior.
1. Glazing Rabbet: For 1 inch insulating glazing.
 2. Glazing Position: Front-set.
 3. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
 4. Finish: High performance organic coatings.
 5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

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8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements

1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Design Wind Loads: Comply with requirements of ASCE 7.
 - b. Positive Design Wind Load: 25 lbf/sq ft.
 - c. Negative Design Wind Load: 25 lbf/sq ft.
 - d. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
3. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.
4. Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F), maximum.

2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 1. Framing members for interior applications need not be thermally broken.
 2. Glazing Stops: Flush.
 3. Structurally Reinforced Members: Where required provide Extruded aluminum with internal reinforcement of structural steel member.

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4. Thermal break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

B. Glazing: As specified in Section 08 80 00.

2.04 VENTING WINDOWS

- A. Basis-of-Design Product: Kawneer North America's "GLASSvent" with flush vent, minimum-sightline design.
- B. Aluminum Windows: Manufacturer's standard units for manual or motorized operation, complying with AAMA/WDMA/CSA 101/I.S.2/A440, with self-flashing mounting fins, and as follows:
 1. Window Type: Awning (project-out); Casement.
 2. Minimum Performance Class: CW.
 3. Minimum Performance Grade: 30.
 4. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 0.064-inch thickness at any location for main frame and sash members.
 5. Thermally Improved Construction: Fabricate window units with an integral, and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
- C. Mullions: Between adjacent windows, fabricated of extruded aluminum matching finish of window units.
- D. Fasteners, Anchors, and Clips: Nonmagnetic stainless steel, aluminum, or other noncorrosive material, compatible with aluminum window members, trim, hardware, anchors, and other components of window units. Fasteners shall not be exposed, except for attaching hardware.
 1. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.128 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, spline grommet nuts.
- E. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze.
 1. Where size of operable window units exceeds capabilities and functionality of manufacturer's standard hardware, provide manufacturer's special hardware for hinges, limit device locking arm controls, and multi-latch or multiple separate cam latch

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lever locks, as required to meet performance requirements and to suit size of window sash.

- F. Limiters: Where operable sash adjoins walking surfaces, as indicated on the drawings, provide units with integrated limiters to prevent the sash from extending more than 4 inches beyond the face of the building wall.
- G. Glazing: Same as adjacent aluminum-framed entrances and storefront glazing.
- H. Finish: Match adjacent aluminum-framed entrances and storefront finish.

2.05 WINDOW CONTROL SYSTEMS

- A. Basis-of-Design Products: Bronze Craft Corporation / Ultraflex Control Systems' (UCS), or equal, mechanical window remote control system.
- B. Performance Requirements: System shall provide group and individual window operation as indicated.
- C. Components: Provide all mounting brackets, hardware, and other required and accessory items for a complete and operational installation.
 - 1. Chain opening mechanisms with stainless steel chain and opening stroke of 10" or 15" as appropriate for window height and hinges used. The connection of the chain bracket to the operable window must have a release pin to allow disconnection of the chain to the window for cleaning.
- D. Electrically Operated Systems: UCS Vega AC series
 - 1. Provide units sized and configured for the window groupings indicated on the drawings.
 - 2. Provide remote wall-mounted push-button operation capable of operating groups of windows concurrently.

2.06 ENTRANCES

- A. Aluminum-Framed Swing Door Entrances and Frames: Factory fabricated, factory finished aluminum doors and frames with infill, and related flashings, anchorage and attachment devices, thermally broken with interior section insulated from exterior.
 - 1. Thickness: 2 1/4 inches.
 - 2. Top Rail: Nominal 5 1/2 inches wide.
 - 3. Intermediate Rail: Nominal 5 1/2 inches wide, where indicated.

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4. Vertical Stiles: Nominal 5 1/2 inches wide.
5. Bottom Rail: 10 inches wide.
6. Glazing Stops: Square.
7. Finish: Same as storefront.

B. Performance Requirements

1. Wind loads: Provide entrance system; include anchorage, capable of withstanding wind load design pressures of 25 lbs./sq. ft. inward and 25 lbs./sq. ft. outward.
2. Air Infiltration: For single acting offset pivot or butt hung entrances in the closed and locked position, the test specimen shall be tested in accordance with ASTM E 283 at a pressure differential of 1.57 psf for single doors and pairs of doors. A single 3'0" x 7'0" entrance door and frame shall not exceed 1.0 cfm/ft². A pair of 6'0" x 7'0" entrance doors and frame shall not exceed 1.0 cfm/ft².
3. Structural Performance: Corner strength shall be tested per the entrance manufacturer's dual moment load test procedure and certified by an independent testing laboratory to ensure weld compliance and corner integrity.
4. Thermal Performance: Computer simulation testing shall be in accordance with NFRC 100/200/500 and AAMA 507-03.

2.07 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209 (ASTM B209M).
- C. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.
- D. Fasteners: Stainless steel.
- E. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch minimum thickness; finish to match framing members.
- F. Concealed Flashings: Stainless steel, 26 gauge, 0.0187 inch minimum thickness.
- G. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- H. Sealant for Setting Thresholds: Non-curing butyl type.

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- I. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- J. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.08 FINISHES

- A. Factory finish all surfaces that will be exposed in completed assemblies.
 - 1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
 - 2. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
- B. Greenhouse Doors: Anodized Finish
 - 1. Color: Clear.
- C. Storefront, Windows and Entrances: High-performance coating
 - 1. Finish Color: As selected by Architect from manufacturer's standard line.
- D. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
- E. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.
 - 1. Manufacturers:
 - a. PPG Metal Coatings; Duranar: www.ppgmetalcoatings.com/#sle.
 - b. Sherwin-Williams Company; Fluropon: www.coil.sherwin.com/#sle.
- F. Color: As selected by Architect from manufacturer's standard range.
- G. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.09 HARDWARE

- A. For each door, include weatherstripping, sill sweep strip, and threshold.
- B. Other Door Hardware: As specified in Section 08 71 00.
- C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

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- D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install all systems in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
1. Coordinate with Greenhouse provider for installation at greenhouse structures.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Install operating sash.
- J. Set thresholds in bed of sealant and secure.
- K. Install hardware using templates provided.
1. See Section 08 71 00 for hardware installation requirements.
- L. Install glass and infill panels in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.

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- M. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

- A. Provide services of storefront manufacturer's field representative to observe for proper installation of system and submit report.
- B. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
1. Perform a minimum of two tests in each designated area as indicated on drawings.
 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
- C. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
1. Perform a minimum of two tests in each designated area as indicated on drawings.
 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
 3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf.
 - a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.
 4. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf.
- D. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

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3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

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SECTION 08 43 14 - ALUMINUM THERMAL SLIDING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum sliding doors and frames.
- B. Weatherstripping.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 07 27 26 - Sheet-Applied Membrane Air Barriers, Vapor Impermeable
- C. Section 07 92 00 - NT Joint Sealants: Sealing joints between frames and adjacent construction.
- D. Section 08 43 13 - Aluminum-Framed Storefronts: Storefronts and swing doors.
- E. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.
- F. Section 08 80 00 - Glazing: Glass and glazing accessories.
- G. Section 12 24 00 - Window Shades: Attachments to framing members.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site 2015.
- B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems 2015.
- C. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems 2014.
- D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.
- E. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).
- F. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

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- G. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- H. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- I. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- J. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- K. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- L. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- M. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.
- N. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.
- O. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.
- P. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014.
- Q. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).
- R. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors 2002 (Reapproved 2018).
- S. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015.
- T. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).

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1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
- B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- C. Samples: Submit two samples minimum 12 x 12 inches in size illustrating finished aluminum surface, glass, infill panels, glazing materials.
- D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- E. Certificate of NFRC Compliance and test report including center-of-glass U value and corresponding overall U value.
- F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- H. Manufacturer's Qualification Statement.
- I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
 - 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
 - a. Insulating Glass Certification Council (IGCC).
 - b. Safety Glazing Certification Council (SGCC).

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B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.

a. North American Contractor Certification (NACC) for glazing contractors.

b. Equivalent independent third-party ANSI accredited certification.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

B. Provide 10 year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

C. Special Warranty: Provide 20 year manufacturer warranty against excessive degradation of high performance coating exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Kawneer North America www.kawneer.com/#sle; AA 3200.

B. Other Acceptable - Aluminum-Framed Storefronts Manufacturers:

1. Arcadia, Inc: www.arcadiainc.com/#sle.

2. R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com/#sle.

3. Oldcastle Building Envelope: www.oldcastlebe.com/#sle.

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2.02 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
 2. Glazing Stops: Flush.
 3. Thermal break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.
- B. Glazing: As specified in Section 08 80 00.

2.03 THERMAL SLIDING DOORS

- A. Aluminum-Framed Sliding Door Entrances and Frames: Factory fabricated, factory finished aluminum doors and frames with infill, and related flashings, anchorage, and attachment devices, thermally broken with interior section insulated from exterior.
1. Frame Depth: Nominal 5 inches (6 3/4 inches overall)
 2. Sliding Panel Thickness: 2 1/4 inches.
 3. Vertical Stiles at Sliding Panels: Nominal 3 3/4 inches wide.
 4. Vertical Stiles at Fixed Panels: Nominal 2 3/4 inches wide.
 5. Top and Bottom Rail at Fixed Panels: Nominal 2 1/4 inches wide.
 6. Top and Bottom Rail at Sliding Panels: Nominal 3 1/2 inches wide.
 7. Low-Rise Sill: Nominal 3/4 inch (not including sill weatherstripping). Provide with beveled transition strip on exterior side.
 8. Glazing Stops: Beveled.
 9. Finish: Same as storefront.
- B. Performance Requirements: Provide sliding aluminum-framed glass doors of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).
1. Performance Class and Grade: AW-PG135-SD
 2. Wind loads: Provide sliding door system; include anchorage, capable of withstanding wind load design pressures of 25 lbs./sq. ft. inward and 25 lbs./sq. ft. outward. The design pressures are based on the California Building Code; 2019 Edition.

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3. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. The air infiltration rate shall not exceed 0.30 cfm/ft² (1.5 L/s•m²) at a static air pressure differential of 1.56 psf (75 Pa).
4. Water Resistance: The test specimen shall be tested in accordance with ASTM E 547 and ASTM E 331. There shall be no leakage as defined in the test method at a static air pressure differential of 15 psf (718 Pa).
 - a. Water performance for optional low profile sill of 4 psf (192 Pa).
5. Uniform Load: A static air design load of 40 PSF (1915 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member at design load. At structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing member in excess of 0.2% of the clear spans shall occur.
6. Forced Entry Resistance: Comply with Performance Grade 10 requirements when tested according to ASTM F 842.
7. Operating Force: Tested according to and complying with ASTM E2068.
8. Energy Efficiency:
 - a. Thermal Transmittance (U-Factor): The thermal transmittance (U-Factor) shall not be more than 0.45 when tested to AAMA 1503.
9. Condensation Resistance Factor (CRF): When tested to AAMA 1503, the Condensation Resistance Factor shall not be less than:
 - a. 57 frame and 66 glass.
10. Sound Transmission class (STC) and Outdoor-Indoor Transmission Class (OITC): When tested in accordance with ASTM E90, the STC and OITC rating shall not be less than:
 - a. 38 (STC) and 33 (OITC).

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209 (ASTM B209M).
- C. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.
- D. Fasteners: Stainless steel.

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- E. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch minimum thickness; finish to match framing members.
- F. Concealed Flashings: Stainless steel, 26 gauge, 0.0187 inch minimum thickness.
- G. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- H. Sealant for Setting Thresholds: Non-curing butyl type.
- I. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- J. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.05 FINISHES

- A. Factory finish all surfaces that will be exposed in completed assemblies.
 - 1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
 - 2. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
- B. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.
 - 1. Manufacturers:
 - a. PPG Metal Coatings; Duranar: www.ppgmetalcoatings.com/#sle.
 - b. Sherwin-Williams Company; Fluropon: www.coil.sherwin.com/#sle.
- C. Color: As selected by Architect from manufacturer's standard range.
- D. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 HARDWARE

- A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock sliding aluminum-framed glass doors.
- B. Standard Hardware:

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1. One pair of stainless steel tandem rollers per sliding panel.
 2. Stainless steel roller track.
 3. Hookbolt lock: 2-point Hookbolt lock.
 4. Pull handle exterior: "D" pull - compatible with cylinder; cylinder specified in Section 08 71 00 - Door Hardware.
 5. Pull handle interior: "D" pull with lever.
- C. Lock Cylinder: As specified in Section 08 71 00.
- D. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
- E. Threshold: Low-profile extruded aluminum, one piece length per door opening, ribbed surface; provide on all doors. Profiles in accordance with drawing details.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install all systems in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.

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- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form watertight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Set thresholds in bed of sealant and secure.
- J. Install hardware using templates provided.
 - 1. See Section 08 71 00 for lock cylinder.
- K. Install glazing in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.
- L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

- A. Provide services of door manufacturer's field representative to observe for proper installation of system and submit report.
- B. Repair or replace components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

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3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

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SECTION 08 62 00 - UNIT SKYLIGHTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Skylights with integral frame.
- B. Integral insulated curb.

1.02 RELATED REQUIREMENTS

- A. Section 07 41 13 - Metal Roof Panels - Standing Seam: Metal roof system.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Skylight counterflashing.

1.03 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights 2017.
- B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.
- C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- G. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights 2019c.

1.04 SUBMITTALS

- A. Product Data: Provide structural, thermal, and daylighting performance values.
- B. Shop Drawings: Indicate configurations, dimensions, locations, fastening methods, and installation details.
- C. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:

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1. Evidence of AAMA Certification.
2. Evidence of WDMA Certification.
3. Evidence of CSA Certification.
4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

D. Manufacturer's Installation Instructions: Indicate special procedures.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than three years documented experience.

1.06 WARRANTY

- A. Provide five year manufacturer warranty, including coverage for leakage due to defective skylight materials or construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Unit Skylights:
1. Kingspan Light + Air, LLC; formerly Bristolite Daylighting Systems, Inc:
www.bristolite.com/#sle; Alumilite GAL CM.
 2. Wasco Skylights - Part of the VELUX Group: www.wascoskylights.com/#sle.

2.02 SKYLIGHTS

- A. Skylights: Factory-assembled glazing in aluminum frame, free of visual distortion, and weathertight.
1. Shape: Rectangular, flat.
 2. Glazing: Sealed insulating glass.
 3. Operation: None; fixed.
 4. Roof Slope: As indicated on drawings.
 5. Nominal Size: As indicated on drawings.

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2.03 PERFORMANCE REQUIREMENTS

- A. Provide unit skylights that comply with the following:
 - 1. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific skylight type:
 - 2. Design Pressure (DP): In accordance with applicable codes.
 - 3. Allow for expansion and contraction within system components caused by a cycling surface temperature range of 170 degrees F without causing detrimental effects to system or components.

2.04 COMPONENTS

- A. Double Glazing: factory sealed.
 - 1. Outer Glazing: Gray tinted transparent. Tempered.
 - 2. Inner Glazing: Laminated clear/white.
- B. Frames: ASTM B221 ASTM B221M Extruded aluminum reinforced and welded corner joints, integral curb frame mounting flange and counterflashing to receive roofing flashing system, with integral condensation gutter, glazing retainer; high performance coating to match roof panels finish.
- C. Support Curbs: Sheet aluminum ASTM B209 ASTM B209M, sandwich construction; 1 inch wide, 4 inches high; glass fiber insulation; with integral flange for anchorage to roof deck.

2.05 ACCESSORIES

- A. Anchorage Devices: Type recommended by manufacturer, concealed.
- B. Counterflashings: Same metal type and finish as skylight frame.
- C. Protective Back Coating: Zinc molybdate alkyd.
- D. Sealant: Elastomeric, silicone or polyurethane, compatible with material being sealed .

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that openings and substrate conditions are ready to receive work of this section.

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3.02 PREPARATION

- A. Apply protective back coating on aluminum surfaces of skylight units that will be in contact with cementitious materials or dissimilar metals.

3.03 INSTALLATION

- A. Install unit skylights in accordance with manufacturer's instructions and ASTM E2112.
- B. Install aluminum curb assembly, fastening securely to roof decking; flash curb assembly into roofing system, separating aluminum materials from metal roofing.
- C. Install skylight units and mount securely to curb assembly; install counterflashing as required.
- D. Apply sealant to achieve watertight assembly.

3.04 CLEANING

- A. Upon completion of installation, thoroughly clean skylight aluminum surfaces in accordance with AAMA 609 & 610.
- B. Remove protective material from prefinished aluminum surfaces.
- C. Wash down exposed surfaces; wipe surfaces clean.
- D. Remove excess sealant.

END OF SECTION

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SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions of Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
- B. This Section includes the following, but is not necessarily limited to:
 - 1. Door Hardware, including electric hardware.
 - 2. Storefront and Entrance door hardware.
 - 3. Gate Hardware.
 - 4. Digital keypad access control devices.
 - 5. Hold-open closers with smoke detectors.
 - 6. Wall or floor-mounted electromagnetic hold-open devices.
 - 7. Power supplies for electric hardware.
 - 8. Low-energy door operators plus sensors and actuators.
 - 9. Thresholds, gasketing and weather-stripping.
 - 10. Door silencers or mutes.
- C. Related Sections: The following sections are noted as containing requirements that relate to this Section, but may not be limited to this listing.
 - 1. Division 8: Section - Steel Doors and Frames.
 - 2. Division 8: Section - Wood Doors.
 - 3. Division 8: Section - Aluminum Storefront
 - 4. Division 28: Section - Fire/Life-Safety Systems & Security Access Systems.

1.03 REFERENCES (USE DATE OF STANDARD IN EFFECT AS OF BID DATE.)

- A. 2019 California Building Code, CCR, Title 24.
- B. BHMA – Builders' Hardware Manufacturers Association
- C. CCR – California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- D. DHI – Door and Hardware Institute
- E. NFPA - National Fire Protection Association.
 - 1. NFPA 80 - Fire Doors and Other Opening Protectives

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2. NFPA 105 - Smoke and Draft Control Door Assemblies

F. UL - Underwriters Laboratories.

1. UL 10C - Fire Tests of Door Assemblies
2. UL 305 - Panic Hardware

G. WHI - Warnock Hersey Incorporated

H. SDI - Steel Door Institute

1.04 SUBMITTALS & SUBSTITUTIONS

- A. General: Submit in accordance with Conditions of the Contract and Division 1 Specification sections.
- B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
- C. Submit six (6) copies of schedule organized vertically into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:
 1. Include a Cover Sheet with;
 - a. Job Name, location, telephone number.
 - b. Architects name, location and telephone number.
 - c. Contractors name, location, telephone number and job number.
 - d. Suppliers name, location, telephone number and job number.
 - e. Hardware consultant's name, location and telephone number.
 2. Job Index information included;
 - a. Numerical door number index including; door number, hardware heading number and page number.
 - b. Complete keying information (referred to DHI hand-book "Keying Systems and Nomenclature"). Provision should be made in the schedule to provide keying information when available; if it is not available at the time the preliminary schedule is submitted.
 - c. Manufacturers' names and abbreviations for all materials.
 - d. Explanation of abbreviations, symbols, and codes used in the schedule.
 - e. Mounting locations for hardware.
 - f. Clarification statements or questions.
 - g. Catalog cuts and manufacturer's technical data and instructions.
 3. Vertical schedule format sample:

Heading Number 1 (Hardware group or set number – HW -1)					
			(a) 1 Single Door #1 - Exterior from Corridor 101	(b) 90°	(c) RH
			(d) 3' 0"x7' 0" x 1-3/4" x (e) 20 Minute (f) WD x HM		
(g) 1	(h)	(i) ea	(j) Hinges - (k) 5BB1HW 4.5 x 4.5 NRP (l) ½ TMS	(m) 626	(n) IVE

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2	6AA	1 ea	Lockset - ND50PD x RHO x RH x 10-025 x JTMS	626	SCH
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(a) - Single or pair with opening number and location. (b) - Degree of opening (c) - Hand of door(s) (d) - Door and frame dimensions and door thickness. (e) - Label requirements if any. (f) - Door by frame material. (g) - (Optional) Hardware item line #. (h) - Keyset Symbol. (i) - Quantity. (j) - Product description. (k) - Product Number. (l) - Fastenings and other pertinent information. (m) - Hardware finish codes per ANSI A156.18. (n) - Manufacture abbreviation.

- D. Make substitution requests in accordance with Division 1. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.
- E. Wiring Diagrams: Provide product data and wiring and riser diagrams for all electrical products listed in the Hardware Schedule portion of this section.
- F. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
- G. 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.
- H. Furnish as-built/as-installed schedule with close-out documents, including keying schedule and transcript, wiring/riser diagrams, manufacturers' installation and adjustment and maintenance information.
- I. Fire Door Assembly Testing: Submit a written record of each fire door assembly to the Owner to be made available to the Authority Having Jurisdiction (AHJ) for future building inspections.
- J. LEED Certification Points: Submit information and certifications necessary to achieve maximum points for LEED certification; coordinate and cooperate with Owner and Architect in providing information necessary for required LEED rating.

1.05 QUALITY ASSURANCE

- A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.
- B. Supplier Qualifications: 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. Meet with Owner to finalize keying requirements and to obtain final instructions in writing. To maintain the integrity of patented key systems provide a letter of authorization from the specified manufacturer indicating that supplier has authorization to purchase the key system directly from the manufacturer.

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3. Stock parts for products supplied and are capable of repairing and replacing hardware items found defective within warranty periods.
- C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.
- D. Fire-Rated Openings: 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.
 1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".
- E. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.
- B. Hardware items shall be individually packaged in manufacturers' original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.
- C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.
- D. Contractor to inventory door hardware jointly with representatives of hardware supplier and hardware installer until each all are satisfied that count is correct.
- E. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
- F. Product packaging to be labelled in compliance with CA Prop 65, Safe Drinking Water and Toxic Enforcement Act of 1986.

1.07 WARRANTY

- A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:
 1. Locksets: "ND" Ten (10) years.
 2. Electronic: One (1) year.
 3. Closers: Thirty (30) years.
 4. Exit devices: Three (3) years.
 5. All other hardware: Two (2) years.

1.08 MAINTENANCE

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- A. Maintenance Tools and Instructions: 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.

1.09 PRE-INSTALLATION CONFERENCE

- A. Convene a pre-installation conference at least one week prior to beginning work of this section.
- B. Attendance: Architect, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, Key District Personnel, and Project Inspector.
- C. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work. Review District's keying standards.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

<u>Item</u>	<u>Manufacturer</u>	<u>Acceptable Substitutes</u>
Hinges	Ives	Hager, Stanley, McKinney
Locks, Latches & Cylinders	Schlage	Or Approved Equal
Exit Devices	Von Duprin	Or Approved Equal
Closers	LCN	Or Approved Equal
Push, Pulls & Protection Plates	Ives	Trimco, BBW, DCI
Flush Bolts	Ives	Trimco, BBW, DCI
Dust Proof Strikes	Ives	Trimco, BBW, DCI
Coordinators	Ives	Trimco, BBW, DCI
Stops	Ives	Trimco, BBW, DCI
Overhead Stops	Glynn-Johnson	Or Approved Equal
Thresholds	Pemko	Zero, National Guard
Seals & Bottoms	Zero	Pemko, National Guard

2.02 MATERIALS

- A. Hinges: Exterior out-swinging door butts shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.

1. Hinges shall be sized in accordance with the following:

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- a. Height:
 - 1) Doors up to 42" wide: 4-1/2" inches.
 - 2) Doors 43" to 48" wide: 5 inches.
 - b. Width: Sufficient to clear frame and trim when door swings 180 degrees.
 - c. Number of Hinges: Furnish 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.
2. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.
- B. Floor Closers: Shall be equipped with compression springs, cam and roller operating mechanism and a one piece spindle-cam for maximum operating performance and longevity.
- C. Pivots: High strength forgings and castings with precision bearings for smooth operation. Positive locking vertical adjustment mechanism to allow installer to precisely position the door and balance the load.
- D. Continuous Hinges: As manufactured by Ives, an Allegion Company. UL rated as required.
- E. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Rhodes" design, fastened with through-bolts and threaded chassis hubs.
1. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
 - a. Abusive Locked Lever Torque Test – minimum 3,100 inch-pounds without gaining access
 - b. Offset lever pull – minimum 1,600 foot pounds without gaining access
 - c. Vertical lever impact – minimum 100 impacts without gaining access
 2. Cycle life - tested to minimum 16 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers
 3. UL 10C for 4'-0" x 10'-0" 3-hour fire door.
 4. Cylinders: Refer to "KEYING" article, herein.
 5. Provide solid steel anti-rotation through bolts and posts to control excessive rotation of lever.
 6. Provide lockset that allows lock function to be changed to over twenty other common functions by swapping easily accessible parts.
 7. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw capable of UL listing of 3 hours on a 4' x 10' opening. Provide proper latch throw for UL listing at pairs.
 8. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
 9. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
 10. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
 11. Provide wired electrified options as scheduled in the hardware sets.
 - a. 12 through 24 volt DC operating capability, auto-detecting
 - b. Selectable EL (fail safe)/EU (fail secure) operating mode via switch on chassis
 - c. 0.230A (230mA) maximum current draw
 - d. 0.010A (10mA) holding current
 - e. Modular / "plug in" request to exit switch
 12. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.

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- F. Deadlocks: Rotating cylinder trim rings of attack-resistant design. Mounting plates and actuator shields of plated cold-rolled steel. Mounting screws of 1/4" diameter steel and protected by drill-resistant ball bearings. Steel alloy deadbolt with hardened steel roller. Strike alloy deadbolt with reinforcer and two 3" long screws. ANSI A156.5, 2001 Grade 1 certified.
- G. Exit devices: Von Duprin as scheduled.
1. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 - 2001 standards.
 2. All internal parts shall be of cold-rolled steel with zinc dichromate coating.
 3. Mechanism case shall have an average thickness of .140".
 4. Compression spring engineering.
 5. Non-handed basic device design with center case interchangeable with all functions.
 6. All devices shall have quiet return fluid dampeners.
 7. All latchbolts shall be deadlocking with 3/4" throw and have a self-lubricating coating to reduce friction and wear.
 8. Device shall bear UL label for fire and or panic as may be required.
 9. All surface strikes shall be roller type and utilize a plate underneath to prevent movement.
 10. Lever Trim: "Breakaway" design, forged brass or bronze escutcheon with a minimum of .130" thickness, match lockset lever design.
 11. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key.
 12. Furnish glass bead kits for vision lites where required.
 13. All Exit Devices to be sex-bolted to the doors.
 14. Panic Hardware shall comply with CBC Section 11B.404.2.7 and shall be mounted between 34" and 44" above the finished floor surface.
 - a. Provide exit devices UL certified to meet maximum 5 pound requirements according to the California Building Code section 11B-309.4, and UL listed for Panic Exterior Fire Exit Hardware maximum opening force of 15 pounds according to the California Building Code section 11B-404.2.9.
- H. Closers: LCN as scheduled. Place closers inside building, stairs, room, etc.
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. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
 2. All door closers shall be fully hydraulic and have full rack and pinion action with a shaft diameter of a minimum of 11/16 inch and piston diameter of 1 inch to ensure longevity and durability under all closer applications.
 3. All parallel arm closers shall incorporate one piece solid forged steel arms with bronze bushings. 1-9/16" steel stud shoulder bolts, shall be incorporated in regular arms, hold-open arms, arms with hold open and stop built in. All other closers to have forged steel main arms for strength, durability, and aesthetics for versatility of trim accommodation, high strength and long life.
 4. All parallel arm closers so detailed shall provide advanced backcheck for doors subject to severe abuse or extreme wind conditions. This advanced backcheck shall be located to begin cushioning the opening swing of the door at approximately 45 degrees. The intensity of the backcheck shall be fully adjustable by tamper resistant non-critical screw valve.
 5. Closers shall be installed to permit doors to swing 180 degrees.

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6. All closers shall utilize a stable fluid withstanding temperature range of 120 degrees F. to -30 degrees F. without requiring seasonal adjustment of closer speed to properly close the door.
 7. Provide the manufactures drop plates, brackets and spacers as required at narrow head rails and special frame conditions. NO wood plates or spacers will be allowed.
 8. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors. Compensating devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs. when specifically approved by fire marshal. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position. Per 11B-404.2.8.1, door shall take at least 5 seconds to move from an open position of 90 degrees to a position of 12 degrees from the latch jamb.
- I. Flush Bolts & Dust Proof Strikes: 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.
1. Manual flush bolts only permitted on storage or mechanical openings as scheduled.
 2. Provide dust proof strikes at openings using bottom bolts.
- J. Door Stops:
1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
 2. Do not install floor stops more than four (4) inches from the face of the wall or partition (CBC Section 11B-307).
 3. 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.
- K. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges. Provide kick plates 10" high and 2" LDW. Sizes of armor and mop plates shall be listed in the Hardware Schedule. Furnish with machine or wood screws of bronze or stainless to match other hardware.
- L. Thresholds: As Scheduled and per details.
1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope.
 2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 7 "Thermal and Moisture Protection".
 3. Use 1/4" fasteners, red-head flat-head sleeve anchors (SS/FHSL).
 4. Thresholds shall comply with CBC Section 11B-404.2.5.
- M. Seals: Provide silicone gasket at all rated and exterior doors.
1. Fire-rated Doors, Resilient Seals: UL10C Classified complies with NFPA 80 & NFPA 252. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements.
 2. Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Furnish fire-labeled opening assembly complete and in full compliance with UL10C Classified

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complies with NFPA 80 & NFPA 252. Where required, intumescent seals vary in requirement by door type and door manufacture -- careful coordination required.

3. Smoke & Draft Control Doors, Provide UL10C Classified complies with NFPA 80 & NFPA 252 for use on "S" labeled Positive Pressure door assemblies.

- N. Door Shoes & Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.
- O. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

2.03 KEYING

- A. Furnish all cylinders in the Patent Protected Schlage Small Format Interchangeable Core. (SFIC) "Everest B" family of keyways. Pack change keys independently (PKI)
- B. Furnish construction keying for doors requiring locking during construction.
 1. For SFIC systems provide 80-035 Small Format Construction Cores in either "BRN" or "GRN" combination for all locks that need to be locked during construction and M204-152 Disposable Cores for all cylinders not required to be locked.
 2. For SFIC systems provide ten 48-310 Const. Keys in either "BRN" or "GRN" combination to match cores in # 1 above.
 3. For SFIC systems provide two 48-311 Control Keys in either "BRN" or "GRN" combination to match cores in # 1 above. (const.)
 4. For SFIC systems provide two control keys for installing the permanent cores (either 48-311 for non-patented keyways or 49-356 for patented keyways such as "Everest -B" family)
- C. Furnish all keys with visual key control.
 1. Stamp key "Do Not Duplicate".
 2. Stamp unique owner identifier from the key bow.
 3. Delete key "bitting" from the key bow.
- D. Furnish all cylinders with visual key control.
 1. Stamp unique owner supplied code on cylinder side. (CKC) (6 character maximum).
- E. Furnish mechanical keys as follows:
 1. Furnish 2 cut change keys for each different change key code.
 2. Furnish 1 uncut key blank for each change key code.
 3. Furnish 6 cut masterkeys for each different masterkey set.
 4. Furnish 3 uncut key blanks for each masterkey set.
 5. Furnish 2 cut control keys cut to the top masterkey for permanent I/C cylinders.
 6. Furnish 1 cut control key cut to each SKD combination.
- F. Furnish Schlage Padlocks and the cylinders to tie them into the masterkey system for gates, storage boxes, utility valve security, roof hatches and roll-up doors keyed as directed in the keying schedule.
 1. Furnish KS43D2200 padlock for use with non-I/C Schlage cylinders. Furnish 47-413 (conventional) or 47-743-XP (PrimusXP) with above.

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2. Furnish KS43G3200 padlock for use with FSIC Schlage cylinders. Furnish 23-030 (Classic / Everest) or 20-740 (PrimusXP) with above.
 3. Furnish KS41D1200 padlock for use with SFIC Schlage cylinders. Furnish 80-037 (Everest-B) with above.
- G. Furnish one Schlage cabinet lock for each cabinet door or drawer so designated on the drawings or keying schedule to match the masterkey system.
1. Furnish CL100PB for use with non-I/C Schlage cylinders.
 2. Furnish CL77R for use with FSIC Schlage cylinders.
 3. Furnish CL721G for use with SFIC Schlage cylinders.

2.04 FINISHES

- A. Generally to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.
- B. Furnish 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 to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

2.05 FASTENERS

- A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.
- B. Screws for butt hinges shall be flathead, countersunk, full-thread type.
- C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.
- D. Provide expansion anchors for attaching hardware items to concrete or masonry.
- E. All exposed fasteners shall have a phillips head.
- F. Finish of exposed screws to match surface finish of hardware or other adjacent work.
- G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.
- B. Beginning of installation means acceptance of existing conditions.

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3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.
- B. Use the templates provided by hardware item manufacturer.
- C. Mounting heights for hardware shall be as recommended by the Door and Hardware Institute. Operating hardware will to be located between 34" and 44" AFF.
- D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- F. Set thresholds for exterior doors in full bed of butyl-rubber sealant.
- G. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.
- H. Hardware Installer shall coordinate with security contractor to route cable to connect electrified locks, panic hardware and fire exit hardware to power transfers or electric hinges at the time these items are installed so as to avoid disassembly and reinstallation of hardware.
- I. Hardware Installer shall also be present with the security contractor when the power is turned on for the testing of the electronic hardware applications. Installer shall make adjustments to solenoids, latches, vertical rods and closers to insure proper and secure operation.
- J. All wiring for electro-mechanical hardware mounted on the door shall be connected through the power transfer and terminated in the interface junction box specified for in the Electrical Section.
- K. Conductors shall be minimum 18 gage stranded, multicolored. A minimum 12 in. loop of conductors shall be coiled in the interface junction box. Each conductor shall be permanently marked with its function.
- L. If a power supply is specified in the hardware sets, all conductors shall be terminated in the power supply. Make all connections required for proper operation between the power supply and the electro-mechanical hardware. Provide the proper size conductors as specified in the manufacturer's technical documentation.

3.03 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Clean adjacent surface soiled by hardware installation.
- C. Final Adjustment: All hardware items in coordination with the District's locksmith, who will then approve and sign off on the baseline installation. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

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- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.
- E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall meet with the District's locksmith on site and re-adjust every item of hardware to restore proper functions of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.04 HARDWARE LOCATIONS

- A. Conform to CCR, Title 24, Part 2; and ADAAG; and the drawings for access-compliant positioning requirements for the disabled.

3.05 FIELD QUALITY CONTROL

- A. Contractor is responsible for providing the services of an Architectural Hardware Consultant (AHC) or a proprietary product technician to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturers' instructions and as specified herein.

3.06 SCHEDULE

- 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 (Mfr.)

ADA	=	Adams Rite Mfg.	Aluminum Door Hardware
GLY	=	Glynn-Johnson Corporation	Overhead Door Stops
IVE	=	Ives	Hinges, Pivots, Bolts, Coordinators, Dust Proof Strikes, Push Pull & Kick Plates, Door Stops & Silencers
JOH	=	L.E. Johnson	Sliding Door Hardware
LCN	=	LCN	Door Closers
PEM	=	Pemko	Thresholds
SCE	=	Schlage Electronics	Electronic Door Components
SCH	=	Schlage Lock Company	Locks, Latches & Cylinders
TRI	=	Trimco	Signs
VON	=	Von Duprin	Exit Devices
ZER	=	Zero International	Gasketing & Weather-stripping

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HARDWARE GROUP NO. 01

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL CLASSROOM LOCK	ND94HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	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	AL	PEM

HARDWARE GROUP NO. 03

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL ENTRANCE LOCK	ND92HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SHOE	234AV	AL	PEM
1	EA	THRESHOLD	PER DETAIL	AL	PEM

HARDWARE GROUP NO. 04

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL CLASSROOM LOCK	ND94HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	MOP 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	AL	PEM

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HARDWARE GROUP NO. 05

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	LD-PA-AX-99-L-2SI-06	626	VON
2	EA	SFIC EVEREST CORE	80-037	626	SCH
2	EA	SFIC RIM CYLINDER	80-159	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	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	AL	PEM

HARDWARE GROUP NO. 06

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	QELX-PA-AX-99-L-06	626	VON
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SFIC RIM CYLINDER	80-159	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	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 SHOE	234AV	AL	PEM
1	EA	THRESHOLD	PER DETAIL	AL	PEM
1		CARD READER - WORK OF DISTRICT'S VENDOR			
1		POWER SUPPLY - WORK OF DISTRICT'S VENDOR			

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HARDWARE GROUP NO. 07

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	LD-PA-AX-99-L-2SI-06	626	VON
2	EA	SFIC EVEREST CORE	80-037	626	SCH
2	EA	SFIC RIM CYLINDER	80-159	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA SRI	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	328AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	566A-223	A	ZER

HARDWARE GROUP NO. 07A

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	QELX-PA-AX-99-L-06-WH	626	VON
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SFIC RIM CYLINDER	80-159	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA SRI	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	328AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	566A-223	A	ZER
1		CARD READER - WORK OF DISTRICT'S VENDOR			
1		POWER SUPPLY - WORK OF DISTRICT'S VENDOR			

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HARDWARE GROUP NO. 08

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224XY	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	ELEC PANIC HARDWARE	QELX-PA-AX-99-EO	626	VON
1	EA	ELEC PANIC HARDWARE	QELX-PA-AX-99-NL-OP-110MD	626	VON
3	EA	SFIC EVEREST CORE	80-037	626	SCH
2	EA	SFIC MORTISE CYL.	80-132	626	SCH
1	EA	SFIC RIM CYLINDER	80-159	626	SCH
2	EA	LONG DOOR PULL	9264 36" 20" O	630-316	IVE
2	EA	SURF. AUTO OPERATOR	4642 WMS 120 VAC	689	LCN
2	EA	ACTUATOR	8310-836T	630	LCN
2	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	THRESHOLD	PER DETAIL	AL	PEM
1	EA	KEY SWITCH	653-04	626	SCE
1		CARD READER - WORK OF DISTRICT'S VENDOR			
1		POWER SUPPLY - WORK OF DISTRICT'S VENDOR			
1		WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

HARDWARE GROUP NO. 09

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224XY	628	IVE
2	EA	PANIC HARDWARE	CD-PA-9947-L-06-WH	626	VON
4	EA	SFIC EVEREST CORE	80-037	626	SCH
2	EA	SFIC MORTISE CYL.	80-132 XQ11-948	626	SCH
2	EA	SFIC RIM CYLINDER	80-159	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA SRI	689	LCN
2	EA	FLOOR STOP/HOLDER	FS43	626	IVE
2	EA	MEETING STILE	328AA-S	AA	ZER
1	EA	GASKETING	328AA-S	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	566A-223	A	ZER

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HARDWARE GROUP NO. 12

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	VANDL OFFICE LOCK	ND91HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	OH STOP & HOLDER	100H	630	GLY
1	EA	GASKETING	328AA-S	AA	ZER
1	EA	DOOR BOTTOM	350AA	AA	ZER

HARDWARE GROUP NO. 13

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	VANDL OFFICE LOCK	ND91HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	328AA-S	AA	ZER
1	EA	DOOR BOTTOM	350AA	AA	ZER

HARDWARE GROUP NO. 14

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	VANDL STOREROOM LOCK	ND96HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 15

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	VANDL STOREROOM LOCK	ND96HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	OH STOP & HOLDER	100H	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

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HARDWARE GROUP NO. 16

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	VANDL CLASSROOM LOCK	ND94HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 17

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SFIC MORTISE CYL.	80-132	626	SCH
1		BALANCE OF HARDWARE BY SLIDING DOOR MANUFACTURER			

HARDWARE GROUP NO. 19

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1	EA	SFIC MORTISE CYL.	80-132	626	SCH
1		BALANCE OF HARDWARE BY OVERHEAD DOOR MANUFACTURER			

HARDWARE GROUP NO. 20

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	SGL CYL DEADBOLT	B660HD	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1		BALANCE OF HARDWARE AS SHOWN IN DETAILS AND SPECIFIED IN 05 50 00			

HARDWARE GROUP NO. 21

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	SGL CYL DEADBOLT	B660HD	626	SCH
1	EA	SFIC EVEREST CORE	80-037	626	SCH
1		BALANCE OF HARDWARE AS SHOWN IN DETAILS AND SPECIFIED IN 05 50 00			

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HARDWARE GROUP NO. 22

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	PADLOCK L/CYL-SFIC	KS41D1200	625	SCH
2	EA	SFIC EVEREST CORE	80-037	626	SCH
1		BALANCE OF HARDWARE AS SHOWN IN DETAILS AND SPECIFIED IN 05 50 00			

HARDWARE GROUP NO. 23

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	PADLOCK L/CYL-SFIC	KS41D1200	625	SCH
3	EA	SFIC EVEREST CORE	80-037	626	SCH
1		BALANCE OF HARDWARE AS SHOWN IN DETAILS AND SPECIFIED IN 05 50 00			

END OF SECTION

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SECTION 08 80 00 - GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units.
- C. Plastic sheet glazing units.
- D. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 06 41 00 - Architectural Wood Casework : Cabinets with requirements for glass doors.
- C. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.
- D. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed borrowed lites.
- E. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.
- F. Section 08 32 03 - Sliding and Folding Walls and Doors: Glazing furnished as part of wall and door assemblies. Alternate Bid
- G. Section 08 36 13 - Sectional Doors: Glazing furnished as part of door assembly.
- H. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly, and windows within storefront system.
- I. Section 08 43 14 - Aluminum Thermal Sliding Doors:Glazing furnished as part of door assembly.
- J. Section 08 62 00 - Unit Skylights: Glazing furnished as part of skylight assembly.
- K. Section 10 28 00 - Commercial Toilet Accessories: Standard metal-framed mirrors.
- L. Section 13 34 13 - Greenhouses: Glazing for greenhouses.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.

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- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- F. ASTM C1036 - Standard Specification for Flat Glass 2021.
- G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- H. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass 2019.
- I. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- J. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2021a.
- K. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.
- L. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2010.
- M. GANA (GM) - GANA Glazing Manual 2008.
- N. GANA (SM) - GANA Sealant Manual 2008.
- O. GANA (LGRM) - Laminated Glazing Reference Manual 2009.
- P. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use 1990 (2016).
- Q. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2017.
- R. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2014, with Errata (2017).
- S. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2017.

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1.04 SUBMITTALS

- A. CALGreen Submittals: Provide the following:
 - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
- B. Product Data on Insulating Glass Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples 6 by 6 inch in size of glass units.
- E. Certificate: Certify that products of this section meet or exceed specified requirements.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in District's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.
 - 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
 - a. Insulating Glass Certification Council (IGCC).
 - b. Safety Glazing Certification Council (SGCC).
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
 - 1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.

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- a. North American Contractor Certification (NACC) for glazing contractors.
- b. Equivalent independent third-party ANSI accredited certification.

1.06 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

- A. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.
- B. Laminated Glass: Provide a ten (10) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.
- C. Polycarbonate Sheet Glazing: Provide a five (5) year manufacturer warranty to include coverage for breakage, coating failure, abrasion resistance, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 GENERAL PRODUCT REQUIREMENTS

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials, Adhesives and Sealants.

2.02 MANUFACTURERS

- A. Float Glass Manufacturers:
 1. Guardian Glass, LLC: www.guardianglass.com/#sle.
 2. Pilkington North America Inc: www.pilkington.com/na/#sle.
 3. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
- B. Laminated Glass Manufacturers:
 1. Viracon, Architectural Glass segment of Apogee Enterprises, Inc: www.viracon.com/#sle.
- C. Plastic Sheet Glazing Manufacturers:

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1. Covestro LLC; Makrolon UV: www.sheets.covestro.com/#sle.
2. Palram: www.palram.com/#sle.
3. Plazit Polygal, the Plastic Sheets Group: www.polygal-northamerica.com/#sle.

2.03 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 1. Design Pressure:
 - a. Positive Design Pressure: 25 psf.
 - b. Negative Design Pressure: 25 psf.
 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7
 4. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges under specified design load to less than 1/175 of glass edge length or 3/4 inch whichever is lesser per IBC 2018, 2403.3
 5. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 3. Solar Optical Properties: Comply with NFRC 300 test method.

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2.04 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
 2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
 3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
 4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
 5. Impact Resistant Safety Glass: Complies with ANSI Z97.1 - Class B, or 16 CFR 1201 - Category I criteria.
 6. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.
 7. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
 2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.

2.05 INSULATING GLASS UNITS

- A. Manufacturers:
1. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
 2. AGC Glass North America, Inc: www.agcglass.com/#sle.
 3. Guardian Glass, LLC: www.guardianglass.com/#sle.
 4. Pilkington North America Inc: www.pilkington.com/na/#sle.
 5. Viracon, Apogee Enterprises, Inc: www.viracon.com/#sle.
 6. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
- B. Insulating Glass Units: Types as indicated.

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1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Metal Edge Spacers: Aluminum, bent and soldered corners.
 4. Spacer Color: Black.
 5. Edge Seal:
 - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
 6. Color: Black.
 7. Purge interpane space with dry air, hermetically sealed.
 8. Capillary Tubes: Provide tubes from air space for insulating glass units without inert type gas that have a change of altitude greater than 2500 feet between point of fabrication and point of installation to permit pressure equalization of air space.
 - a. Capillary Tubes: Tubes to remain open and be of length and material type in accordance with insulating glass fabricator's requirements.
- C. Insulating Glass Units for Storefront, Windows and Sliding Doors: Vision glass, double glazed.
1. Applications: Exterior glazing unless otherwise indicated.
 2. Basis of Design: Vitro Architectural Glass Solarban 70 Solargray + Clear.
 3. Space between lites filled with argon.
 4. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
 - a. Tint: Gray.
 - b. Coating: Self-cleaning type, on #1 surface.
 - c. Coating: Low-E (solar control type), on #2 surface.
 5. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.

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6. Total Thickness: 1 inch.
 7. Thermal Transmittance (U-Value): 0.28, nominal.
 8. Visible Light Transmittance (VLT): 32% percent, nominal.
 9. Shading Coefficient: 0.23, nominal.
 10. Solar Heat Gain Coefficient (SHGC): 0.19, nominal.
 11. Visible Light Reflectance, Outside: 7% percent, nominal.
 12. Glazing Method: Dry glazing method, gasket glazing.
- D. Insulating Glass Units for Unit Skylights: Vision glass, double glazed.
1. Applications: Skylights above non-conditioned exterior walkways.
 2. Basis of Design: Vitro Architectural Glass.
 3. Space between lites filled with air.
 4. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
 - a. Tint: Gray.
 - b. Coating: Self-cleaning type, on #1 surface.
 5. Inboard Lite: Laminated float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
 - b. Interlayer: PVB. Color: White
 6. Total Thickness: 1 inch.
 7. Glazing Method: Dry glazing method, gasket glazing.
- E. Insulating Glass Units for Sectional Doors, and other locations where obscure glass is noted (designated unconditioned spaces): Vision glass, double glazed.
1. Applications: Door panels.
 2. Basis of Design: Vitro Architectural Glass.
 3. Space between lites filled with air.
 4. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.

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- a. Tint (Obscure): Clear, frosted.
- 5. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
- 6. Total Thickness: 1/2 inch.
- 7. Glazing Method: Dry glazing method, gasket glazing.

2.06 GLAZING UNITS

- A. Monolithic Interior Vision Glazing:
 - 1. Applications: Interior glazing unless otherwise indicated.
 - 2. Glass Type: Fully tempered float glass.
 - 3. Tint: Clear.
 - 4. Thickness: 1/4 inch, nominal.
 - 5. Glazing Method: Wet/dry glazing method, preformed tape and sealant.
- B. Monolithic Interior Vision Glazing for Cabinet Doors:
 - 1. Applications: Casework.
 - 2. Glass Type: Laminated float glass.
 - 3. Tint: Clear.
 - 4. Thickness: 3/16 inch, nominal.
 - 5. Glazing Method: Cabinet fabricator's standard.

2.07 PLASTIC SHEET GLAZING UNITS

- A. Multiwall Standing Seam Polycarbonate Sheet: Ultraviolet (UV) protected.
 - 1. Applications: Horizontal and vertical locations as indicated on drawings.
 - 2. Type: Cellular (multiwall structure) sheet.
 - 3. Tint: Clear. UV protective film on one side.
 - 4. Multiwall Thickness: Nominal 5/16 inch overall, with polycarbonate joiner along both sides.

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5. Width: 48 inch and 72 inch sheets cut to lengths and widths to minimize seams.
6. NFPA Class A Rated when tested in accordance with ASTM E84:
 - a. Flamespread: 0
 - b. Smoke Developed: 60
7. Glazing Method: As required for application indicated on drawings.
8. Manufacturers:
 - a. PlazitPolygal: www.plazit-polygal.com/#sle.

2.08 GLAZING COMPOUNDS

- A. Type GC-1 - Glazing Putty: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; gray color.
- B. Type GC-2 - Butyl Sealant: Single component; ASTM C920 Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.
- C. Type GC-3 - Polysulfide Sealant: Two component; chemical curing, non-sagging type; ASTM C920 Type M, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.
- D. Type GC-4 - Polyurethane Sealant: Single component, chemical curing, non-staining, non-bleeding; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 20 to 35; color as selected.
- E. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.
- F. Manufacturers:
 1. BASF Corporation: www.basf.com/#sle.
 2. Bostik Inc: www.bostik-us.com/#sle.
 3. Dow Corning Corporation: www.dowcorning.com/construction/#sle.
 4. Pecora Corporation: www.pecora.com/#sle.
 5. Tremco Commercial Sealants & Waterproofing; Proglaze SSG: www.tremcosealants.com/#sle.

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2.09 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
 - 1. Width: As required for application.
 - 2. Thickness: As required for application.
 - 3. Spacer Rod Diameter: As required for application.
 - 4. Manufacturers:
 - a. Pecora Corporation: www.pecora.com/#sle.
 - b. Tremco Global Sealants: www.tremcosealants.com/#sle.
- D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

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3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - WET/DRY GLAZING METHOD (PREFORMED TAPE AND SEALANT)

- A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

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- B. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with butyl sealant.
- C. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
- D. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- E. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.
- F. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch below sight lines.
 - 1. Place glazing tape on glazing pane of unit with tape flush with sight line.
- G. Fill gap between glazing and stop with butyl type sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.
- H. Apply cap bead of butyl type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.06 INSTALLATION - PLASTIC GLAZING

- A. Cut panels to fit frames snugly and neatly.
- B. Do not crush or dent multi-wall glazing materials.
- C. Utilize matching plastic extrusions where required to produce panel widths indicated on drawings. Locate joints symmetrically.
- D. Where aluminum trim is indicated, provide clear anodized finished profiles pre-drilled for fasteners to bind panel edges and provide attachment to framing.

3.07 FIELD QUALITY CONTROL

- A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
- B. Monitor and report installation procedures and unacceptable conditions.

3.08 CLEANING

- A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

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- B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- C. Remove non-permanent labels immediately after glazing installation is complete.
- D. Clean glass and adjacent surfaces after sealants are fully cured.
- E. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.09 PROTECTION

- A. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

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SECTION 09 05 61 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
 - 1. Resilient tile.
 - 2. Epoxy flooring.
- B. Preparation of new concrete floor slabs for installation of floor coverings.
- C. Testing of concrete floor slabs for moisture and alkalinity (pH).
- D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
 - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
- E. Patching compound.
- F. Remedial floor coatings.
- G. Remedial floor sheet membrane.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 01 74 19 - Construction Waste Management and Disposal: Handling of existing floor coverings removed.
- C. Section 03 30 00 - Cast-in-Place Concrete: Concrete admixture for slabs to receive adhered flooring, to prevent moisture content-related flooring failures.
- D. Section 03 30 00 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

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1.03 PRICE AND PAYMENT PROCEDURES

- A. Unit Price for Remedial Floor Coating or Sheet Membrane: Do not include the cost of the floor coating or underlayment in the base bid; state on the bid form the unit price per square foot for the floor coating or underlayment, installed, in the event such remediation is required.
 - 1. Base the unit price on a total quantity calculated by assuming that only 50 percent of the flooring will require the alternate adhesive.

1.04 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens) 2021.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete 2020.
- C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.
- D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.06 SUBMITTALS

- A. CALGreen Submittals:
 - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content.
- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.
 - 2. Manufacturer's required bond/compatibility test procedure.
- C. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.

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1. Manufacturer's qualification statement.
2. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
4. Manufacturer's installation instructions.
5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

D. Testing Agency's Report:

1. Description of areas tested; include floor plans and photographs if helpful.
2. Summary of conditions encountered.
3. Moisture and alkalinity (pH) test reports.
4. Copies of specified test methods.
5. Recommendations for remediation of unsatisfactory surfaces.
6. Product data for recommended remedial coating.
7. Include certification of accuracy by authorized official of testing agency.
8. Submit report to Architect.
9. Submit report not more than two business days after conclusion of testing.

E. Adhesive Bond and Compatibility Test Report.

F. Floor Moisture Testing Technician Certificate: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician- Grade I certificate.

1.07 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.
- C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.

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1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- D. Contractor's Responsibility Relating to Independent Agency Testing:
1. Provide access for and cooperate with testing agency.
 2. Confirm date of start of testing at least 10 days prior to actual start.
 3. Allow at least 4 business days on site for testing agency activities.
 4. Achieve and maintain specified ambient conditions.
 5. Notify Architect when specified ambient conditions have been achieved and when testing will start.
- E. Floor Moisture Testing Technician Qualifications: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician Certification- Grade I.
- F. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

1.09 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.

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- B. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
 2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
 3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
 4. Products:
 - a. H.B. Fuller Construction Products, Inc; TEC Feather Edge Skim Coat:
www.tecspecialty.com/#sle.
- C. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.
- D. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
 2. Products:
 - a. Allied Construction Technologies, Inc; AC Tech 2170:
www.actechperforms.com/#sle.
 - b. ARDEX Engineered Cements; ARDEX MC RAPID:
www.ardexamericas.com/#sle.
 - c. Custom Building Products; TechMVC Moisture Vapor and Alkalinity Barrier:
www.custombuildingproducts.com/#sle.
 - d. Floor Seal Technology, Inc; MES 100 with Floor Seal FloorCem SLU:
www.floorseal.com/#sle.

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- e. LATICRETE International, Inc; LATICRETE NXT Vapor Reduction Coating with LATICRETE NXT Level Plus: www.laticrete.com/#sle.
 - f. LATICRETE International, Inc; LATICRETE SUPERCAP Moisture Vapor Control with LATICRETE SUPERCAP Underlayment: www.laticrete.com/#sle.
 - g. Maxxon Corporation; Aquafin SG2: www.maxxon.com/#sle.
 - h. Proflex Products, Inc; Moisture Barrier 25 with DPU - Deep Pour Underlayment: www.proflex.us/#sle.
 - i. Sika Corporation; Sikafloor Moisture Tolerance Epoxy Primer and Sikafloor Self-Leveling Moisture Tolerant Resurfacer: www.sikafloorusa.com/#sle.
 - j. Stauf USA, LLC; ERP-270 Perma-Seal: www.staufusa.com/#sle.
 - k. Tnemec Company, Inc; Series 208 Epoxoprime MVT: www.tnemec.com/#sle.
 - l. UZIN, a division of UFLOOR Systems Inc; UZIN PE 460 with UZIN PE 280 and UZIN NC 170 LevelStar: www.ufloorsystems.com/#sle.
- E. Remedial Floor Sheet Membrane: Pre-formed multi-ply sheet membrane installed over concrete subfloor and intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
- 1. Thickness: 28 mil (0.028 inch).
 - 2. Tape: Types recommended by underlayment manufacturer to install membrane and cover seams.
 - 3. Products:
 - a. GCP Applied Technologies; Kovara MBX: www.gcpat.com/#sle.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

- A. Follow recommendations of testing agency.
- B. Perform following operations in the order indicated:
 - 1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
 - 2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:

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3. Preliminary cleaning.
4. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
5. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
6. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
7. Specified remediation, if required.
8. Patching, smoothing, and leveling, as required.
9. Other preparation specified.
10. Adhesive bond and compatibility test.
11. Protection.

C. Remediations:

1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

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3.03 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- F. Report: Report the information required by the test method.

3.04 INTERNAL RELATIVE HUMIDITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

3.05 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

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3.06 PREPARATION

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with recommendations of testing agency.
- C. Comply with requirements and recommendations of floor covering manufacturer.
- D. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- E. Do not fill expansion joints, isolation joints, or other moving joints.

3.07 ADHESIVE BOND AND COMPATIBILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

3.08 APPLICATION OF REMEDIAL FLOOR COATING

- A. Comply with requirements and recommendations of coating manufacturer.

3.09 INSTALLATION OF REMEDIAL FLOOR Sheet Membrane

- A. Install in accordance with sheet membrane manufacturer's instructions.

3.10 PROTECTION

- A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

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SECTION 09 22 36 - LATH

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal lath for cement plaster.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 06 10 00 - Rough Carpentry.
- C. Section 07 25 00 - Weather Barriers: Weather barrier under exterior plaster and stucco.
- D. Section 07 27 26 -Sheet-Applied Membrane Air Barriers, Vapor Impermeable: Weather barrier under exterior plaster and stucco.
- E. Section 07 46 49 - Poly-Ash Siding and Trim
- F. Section 09 24 00 - Portland Cement Plastering.

1.03 REFERENCE STANDARDS

- A. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring 2003 (Reapproved 2018).
- B. ASTM C847 - Standard Specification for Metal Lath 2018.
- C. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2020.
- D. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster 2021.

1.04 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Product Data: Provide data on furring and lathing components, structural characteristics, material limitations, and finish.
- C. Samples:
 - 1. Submit two samples, 12 by 12 inch in size illustrating lath material and finish.

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2. Submit two samples, 12 inches in length illustrating edge and corner beads, control joints, and other lath accessories.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of each installation standard referenced on site throughout the duration of lathing and plastering work.
- B. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Lath and Accessories:
 1. CEMCO: www.cemcosteel.com/#sle.
 2. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com/#sle.

2.02 LATH

- A. Diamond Mesh Metal Lath: ASTM C847, galvanized; self-furring.
 1. Weight: To suit application and as specified in ASTM C841 or ASTM C1063 for framing spacing.
 2. Weight: 3.4 lb/sq yd.
 3. Backed with treated paper.
- B. Corner Mesh: Formed sheet steel, minimum 0.018 inch thick, perforated flanges shaped to permit complete embedding in plaster, minimum 2 inch size; same finish as lath.
- C. Strip Mesh: Expanded metal lath, same weight as lath, 2 inch wide by 24 inch long; same finish as lath.
- D. Beads, Screeds, Joint Accessories, and Other Trim: Depth governed by plaster thickness, and maximum possible lengths.
 1. Material: Formed sheet steel with rust inhibitive primer, expanded metal flanges.
 2. Casing Beads with Weep Holes: Square edges.
 3. Corner Beads: Radius corners.

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4. Expansion Joints: Accordion profile with factory-installed protective tape, 2 inch wide flanges.
5. Base Screeds: Bevelled edges.
6. Control Joints: Accordion profile with factory-installed protective tape, 2 inch flanges.
7. Reveal Joints: Extruded aluminum with clear anodized finish intended for use in conjunction with cement plaster. Profiles as detailed.

2.03 ACCESSORIES

A. Soffit Vents:

1. Vulcan Fire and Ember Resistant Continuous Soffit Vent: NewCal Metals at [Phone: \(916\) 652-7424www.vulcanvents.com](http://www.vulcanvents.com).
2. Continuous perforated aluminum soffit vent with flanged profile and aluminum honeycomb core. Unit finished with Intumescent coating.
3. Unit shall be listed by California State Fire Marshal for use in the Wildland Urban Interface and shall have successfully passed the ASTM testing standards for ember and flame intrusion (ASTM E 2886 and ASTM E 2886M).
4. Note: Unit is not intended to be painted.

B. Anchorage: Tie wire, nails, and other metal supports, of type and size to suit application; to rigidly secure materials in place, galvanized.

C. Tie Wire: Annealed galvanized steel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that substrates are ready to receive work and conditions are suitable for application.
- C. For exterior plaster and stucco on stud walls, verify that water-resistive barrier has been installed over sheathing substrate completely and correctly.
- D. Do not begin until unacceptable conditions have been corrected.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

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3.02 INSTALLATION - GENERAL

- A. Install metal lath and furring for Portland cement plaster in accordance with ASTM C1063.
- B. Install lath and furring for fire-rated assemblies in accordance with requirements of assembly as indicated.

3.03 CONTROL AND EXPANSION JOINT INSTALLATION

- A. Locate joints as indicated on drawings and comply with ASTM C1063.
 - 1. Area of plaster panel not to exceed 144 sq ft for vertical surfaces.
 - 2. Spacing between control joints not to exceed 12 feet in each direction.
 - 3. Area bounded by control joints not to exceed a length-to-width ratio of 2-1/2 to 1.
- B. Install expansion joints where an expansion joint occurs in base exterior wall.
- C. Install prefabricated joint accessories in accordance with ASTM C1063.
- D. Construct expansion joints of back-to-back casing beads with a backer rod and sealant, set 1/4 inch apart.

3.04 LATH INSTALLATION

- A. Apply lath taut, with long dimension perpendicular to supports.
- B. Lap or nest ends of metal lath in accordance with ASTM C841.
- C. Secure end laps with tie wire where they occur between supports.
- D. Attach lath to wood supports using nails at maximum 8 inches on center.
- E. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches from corner to form the angle reinforcement; fasten at perimeter edges only.
- F. Place corner bead at external wall corners; fasten at outer edges of lath only.
- G. Place base screeds at termination of plaster areas; secure rigidly in place.
- H. Place lath vertically above each top corner and each side of door frames to 6 inches above ceiling line.
- I. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.
- J. Place additional strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

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3.05 TOLERANCES

- A. Maximum Variation from True Lines and Levels: 1/8 inch in 10 feet.
- B. Maximum Variation from True Position: 1/8 inch.

END OF SECTION

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SECTION 09 24 00 - PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Exterior Portland cement plaster assembly
- B. Acrylic finish system

1.02 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- C. Section 07 27 26 - Sheet-Applied Membrane Air Barriers, Vapor Impermeable
- D. Section 07 62 00 - Sheet Metal Flashing and Trim
- E. Section 07 92 00 - Joint Protection
- F. Section 08 43 13 - Aluminum-Framed Storefronts
- G. Section 09 29 00 - Gypsum Board: Exterior gypsum sheathing

1.03 REFERENCES

- A. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar
- B. ASTM C578 - Specification for Preformed, Cellular Polystyrene Thermal Insulation
- C. ASTM C847 - Standard Specification for Metal Lath
- D. ASTM C897 - Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plaster
- E. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster
- F. [ASTM C933 - Standard Specification for Welded Wire Lath](#)
- G. ASTM C1032 - Standard Specification for Woven Wire Plaster Base
- H. ASTM C1063 - Standard Specification for Installation of Lathing and Furring for Portland Cement Based Plaster

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- I. ASTM C1177 - Specification for Glass Mat Gypsum for Use as Sheathing
- J. ASTM C1278 - Specification for Fiber-Reinforced Gypsum Panel
- K. ASTM C1396 - Standard Specification for Gypsum Board
- L. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials
- M. ASTM E119 - Method for Fire Tests of Building Construction and Materials
- N. ASTM E330 - Test Method for Structural Performance of Windows, Curtain Walls, and Doors by Uniform Static air Pressure Difference
- O. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
- P. ICC Acceptance Criteria 212 - Acceptance Criteria For Water-Resistive Coatings Used As Water-Resistive Barriers Over Exterior Sheathing
- Q. ICC Acceptance Criteria 219 - Acceptance Criteria for Exterior Insulation And Finish Systems

1.04 SUBMITTALS

- A. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
- B. General: Submit Samples, Water resistive barrier coating Evaluation Reports and manufacturers' product datasheets in accordance with Division 1 General Requirements Submittal Section.
- C. Samples: Submit samples for approval. Samples shall be of materials specified and of suitable size as required to accurately represent each color and texture used on project. Prepare each sample using same tools and techniques for actual project application. Maintain and make available, at job site, approved samples.
- D. Mock-Up: Applicator to provide full system onsite mockups as necessary to be approved by Project Designer.
- E. Manufacturer's Warranty: Submit sample copies of Manufacturer's Warranty indicating Single Source Responsibility for Water Resistive Barrier coating, Stucco Base coat, finish coat and optional Primer, level coat and reinforcing mesh as specified.

1.05 QUALITY ASSURANCE

- A. Qualifications:

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1. Manufacturer: Shall have marketed cement plaster assemblies in United States for at least ten years and shall have completed projects of same general scope and complexity.
2. Applicator: Shall be experienced and competent in installation of cement plaster materials, and shall provide evidence of a minimum of five years experience in work similar to that required by this section.

B. Stucco Functional Criteria:

1. General: Stucco application shall be to vertical substrates or to substrates sloped for positive drainage. Substrates sloped for drainage shall have additional protection from weather exposure that might be harmful to coating performance.
2. Performance Requirements of Water Resistive Barrier Coating

Weatherseal Testing	Method	ICC and ASTM E2570 Criteria	Results
Accelerated Weathering	AC 212	25 Cycles followed by Hydrostatic Pressure Test: No water penetration on the plane of the exterior facing side of the substrate.	Pass: no water penetration
Air Infiltration	ASTM E2178	Calculated flow Rate at 75 Pa (1.57 lb/ft ² , 0.3 in H ₂ O) = < 0.02 L/m ² *s (< 0.004 cfm/ft ²)	< .00001 L/m ² *s (0.00001 cfm/ft ²) at 75 Pa (1.57 lb/ft ² , 0.3 in H ₂ O)
Air Leakage	ASTM E283	No Criteria	< 0.004 cfm/ft ²
Elongation	ASTM D412	No Criteria	360%
Flexibility	ASTM D522	No Criteria	No Cracking at 1/8 in (3 mm)
Freeze-Thaw Resistance	ASTM E 2485	10 Cycles	Pass – No Deleterious Effects
Hydrostatic Pressure Test	AATCC 127 (Water Column)	Resist 21.6 in (55 cm) water for 5 hours before and after aging	Pass: no water penetration
Nail Sealability, Head of Water	ASTM D1970	No Criteria	Pass: 5 inches of water
Racking	ASTM E72	Deflection at 1/8 in (3.2 mm)	Pass: no cracking at field, joints or flashing connection

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Restrained Environmental	ICC ES AC 212 / ASTM E2570	5 Cycles of wetting and drying	Pass: no cracking at field, joints or flashing connection
Structural Loading	ASTM E1233 Procedure A	10 Cycles @ 80% design load	Pass: no cracking at field, joints or flashing connection
Surface Burning Characteristics	ASTM E84	Flame Spread <25 Smoke Developed <450	Flame Spread =0 Smoke Developed =0
Tensile Bond Strength	ASTM E 2134/ ASTM C 297	Minimum 15 psi (104 kPa)	Pass all listed substrates and flashing materials
Water Resistance	ASTM D 2247	14 Days	Pass: no Deleterious Effects.
Water Penetration	ASTM E331	2.86 psf (137 Pa) for 15 minutes	Pass: 25.4 psf (1216 Pa) for 165 minutes
Water Penetration	ASTM E331	Tested after Structural Loading, Racking and Restrained Environmental Cycling at 2.86 psf (137 Pa) for 15 minutes	No Water Penetration
Water vapor transmission	ASTM E96 Procedure B	Vapor Permeable	12.0 perms
Weathering	ICC ES AC 212 / ASTM E2570	210 hours of UV Exposure, 25 cycles of accelerated weathering, 21.6 in (549 mm) water column for 5 hours	Pass
Wind Driven Rain	F.S. TT-C-555B	No Criteria	Pass
VOC	EPA Reference Test Method 24	US EPA, South Coast AQMD and Greenseal Standard	10 g/L

3. Performance Requirements of Coatings applied to Expanded polystyrene features:
Must comply with ASTM E 2568 or ICC Acceptance Criteria AC 219 for EIFS.

C. Substrate Conditions:

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1. Substrate materials and construction shall conform to the the building code having jurisdiction
 2. Substrates shall be sound, dry and free of dust, dirt, laitance, efflorescence and other harmful contaminants.
 3. Substrate Dimensional Tolerances: Flat with ¼ in within any 10 ft radius.
 4. Maximum deflection of substrate system under positive or negative design loads shall not exceed L/360 of span.
- D. Expansion and Control Joints: Continuous expansion and control joints shall be installed at locations in accordance with ASTM C1063 and ASTM C926.
1. Substrate movement, and expansion and contraction of LaHabra Fastwall 300 WaterMaster Stucco Assembly and adjacent materials shall be taken into account in design of expansion joints, with proper consideration given to sealant properties, installation conditions, temperature range, coefficients of expansion of materials, joint width to depth ratios, and other material factors. Minimum width of expansion joints shall be as specified by the designer or shown on the project drawings.
 2. In accordance with ASTM C1063, expansion or control joints shall be installed in walls not more than 144 ft² (13.4 m²) in area, and not more than 100 ft² (9.3 m²) in area for all non-vertical applications. The distance between joints shall not exceed 18 ft (5.5 m) in either direction or a length-to-width ratio of 2-½ to 1.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver cement plaster products in original packaging with manufacturer's identification.
- B. Storage: Store cement plaster products in a dry location, out of direct sunlight, off the ground, and protected from moisture.

1.07 SITE / ENVIRONMENTAL CONDITIONS

- A. Substrate Temperature: Do not apply cement plaster products to substrates whose temperature are below 40°F (4°C) or contain frost or ice.
- B. Inclement Weather: Do not apply cement plaster products during inclement weather, unless appropriate protection is employed.
- C. Sunlight Exposure: Avoid, when possible, installation of the LaHabra products in direct sunlight. Application of finishes in direct sunlight in hot weather may adversely affect aesthetics.

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- D. Do not apply cement plaster base coats or finishes if ambient temperature falls below 40°F (4°C) within 24 hours of application. Protect cement plaster from uneven and excessive evaporation during dry weather and strong blasts of dry air.
- E. Prior to installation, the wall shall be inspected for surface contamination, or other conditions that may adversely affect the performance of the Stucco Assembly, and shall be free of residual moisture.

1.08 COORDINATION AND SCHEDULING:

- A. Coordination: Coordinate Stucco Assembly installation with other construction operations.

1.09 WARRANTY

- A. Warranty: Provide cement plaster system Manufacturer's Standard 5 Year Limited Stucco Warranty

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials, Adhesives and Sealants.
- B. Basis of Design Manufacturer: Parex USA, Inc., 4125 E. La Palma Ave., Suite 250, Anaheim, CA 92807.
- C. Cement Plaster systems of equivalent construction and performance characteristics:
 - 1. Sto Americas: www.stocorp.com: Sto Powerwall.
 - 2. Sika: <https://usa.sika.com/en/construction/plaster-stucco>: BMI.
- D. Components: Obtain components manufactured by Cement Plaster system manufacturer from authorized distributors. No substitutions or additions of other materials are permitted without prior written permission from Cement Plaster system manufacturer for this project.

2.02 ASSEMBLY DESCRIPTION

- A. Basis of Design: LaHabra FastWall 300 WaterMaster Krak-Shield™ Stucco Assembly: Sheet-applied membrane air barrier, water resistive barrier sheet, metal lath, LaHabra Fiber-47 Fastwall Scratch & Brown (LaHabra Fiber-47 Fastwall Scratch & Brown Concentrate or LaHabra Fiber-47 Fastwall Scratch & Brown Sanded) (3/4 inch), Parex USA fiberglass reinforcing mesh embedded in Parex USA Stucco Level Coat, and an acrylic based finish coat.

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2.03 MATERIALS

- A. LaHabra Fiber-47 Fastwall Scratch & Brown (3/4")
 - 1. LaHabra Fiber-47 Fastwall Scratch & Brown Concentrate: A factory blended portland cement, fibers, hydrated lime and proprietary ingredients, cement scratch and brown coat mixed in the field with sand, conforming to ASTM C926.
- B. Parex USA Adacryl Acrylic Bonder & Admix: 100% acrylic emulsion additive for portland cement based products, to enhance curing, adhesion, freeze-thaw resistance and workability and as an acrylic polymer bonding agent.
- C. Leveling and Reinforcing Coat (Krak-Shield Stucco Assembly):
 - 1. Parex USA Stucco Level Coat™: Copolymer based, factory blend of cement and proprietary ingredients requiring addition of water.
 - 2. Parex USA 355 Standard Mesh: Weight 4.5 oz/yd² (153 g/m²) reinforcing mesh.
- D. Parex USA Primer: 100% acrylic based coating to prepare surfaces for LaHabra acrylic or elastomeric finishes.
- E. LaHabra Finish:
 - 1. Perma-Finish EIFS & Stucco Acrylic Finish: Factory blended, 100% acrylic polymer-based finish, integrally colored.
 - 2. Finish texture and color as selected by Project Designer

2.04 RELATED MATERIALS AND ACCESSORIES

- A. General: LaHabra Fastwall 300 WaterMaster and its related materials shall conform ASTM C926, this specification and Product Data Sheets.
- B. Substrate Materials: Refer to drawing details
- C. Water-Resistive Barrier: Refer to Section 07 27 26 - Sheet-Applied Membrane Air Barrier, Vapor Impermeable.
- D. Lath and Accessories: Conform to ASTM C847, ASTM C933, ASTM C1032, ASTM C1063 and Appendix.
 - 1. Refer to Section 09 22 36 - Lath.
- E. Seals, Sealants and Bond Breakers: Sealants shall conform to ASTM C920, Grade NS, Class 25, Use NT. Backer rod shall be closed-cell polyethylene foam.

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PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify project site conditions under provisions of Division 01, General Requirements.
- B. Compliance: Comply with manufacturer's instructions for installation of Stucco Assembly.
- C. Substrate Examination: Examine prior to Stucco Base installation as follows:
 - 1. Substrate shall be examined for soundness, and other harmful conditions.
 - 2. Substrate shall be free of dust, dirt, laitance, efflorescence, and other harmful contaminants.
 - 3. Substrate construction in accordance with substrate material manufacturer's specifications and
- D. Ensure that flashing has been installed per Specification Section 07 62 00 - Flashing and Sheet Metal.
- E. Advise Contractor of discrepancies preventing installation of the LaHabra Fastwall 300 WaterMaster Stucco Assembly. Do not proceed with the LaHabra Fastwall 300 WaterMaster Stucco Assembly work until unsatisfactory conditions are corrected.

3.02 PREPARATION

- A. Wire Fabric Lath and Metal Lath: Install according to ASTM C1063 and Appendix and the Building Code.
- B. Refer to Section 09 22 36 - Lath.

3.03 MIXING

- A. Mix proprietary products in accordance with manufacturer's instructions, including the applicable manufacturer's Stucco Assembly Product Data Sheets.
 - 1. Basis of Design: Parex USA Adacryl Acrylic Bonder & Admix: Mix up to 1 gallon per 1 bag of LaHabra Fastwall 300. Add after dry components and the majority of the water has been mixed. Mix no longer than required to provide a uniform mixture. DO NOT OVER-MIX. Overmixing entrains excessive amounts of air which weaken the material. Do not re-temper mixes over 20 minutes old.

3.04 APPLICATION

- A. General: Cement plaster system and its related materials shall conform to ASTM C926, this specification and Product Data Sheets

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- B. Water-Resistive Barrier: Refer to Section 07 27 26 - Sheet-Applied Membrane Air Barrier, Vapor Impermeable.
- C. Water-resistive barrier covered by a water vapor permeable intervening material sheet such as building paper. Refer to Section 09 22 36 - Lath.
- D. Stucco Base:
 - 1. Scratch Coat:
 - a. Apply scratch coat to a minimum thickness of 3/8 inch, using sufficient trowel pressure to key cement plaster into lath or to create bond to substrates as applicable.
 - b. Prior to initial set, scratch horizontally to provide key for bond of brown coat.
 - c. Moist cure scratch coat with clean potable water for at least 48 hours in accordance with ASTM C926 and the building codes following initial application (unless brown coat is applied as soon as the scratch coat has achieved sufficient rigidity to support the brown coat).
 - 2. Brown Coat:
 - a. Apply brown coat to a minimum thickness of 3/8 inch, using sufficient trowel pressure to key cement plaster into scratch coat.
 - b. Rod surface to true plane and float to densify.
 - c. Trowel to smooth and uniform surface to receive acrylic polymer finish coat
 - d. Moist cure brown coat with clean potable water for at least 48 hours, in accordance with ASTM C926 and the building codes.
- E. Leveling and Reinforcing Coat (Basis of Design: LaHabra Fastwall 300 WaterMaster Krak-Shield Stucco Assembly):
 - 1. After Moist Curing, allow LaHabra Fastwall 300 WaterMaster Stucco Base to air dry for 24 hours before applying the leveling and reinforcing coat.
 - 2. Using a stainless steel trowel, apply the Stucco Level Coat over the Stucco Base at a thickness of 1/16 - 3/32 in.
 - 3. Fully embed the reinforcing mesh, into the wet Stucco Level Coat including diagonal strips at corners of openings and trowel smooth. Seams are overlapped 2½ inch.
 - 4. The acrylic primers and finishes can be applied as soon as the Stucco Level Coat has cured, typically after 24 hours.

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F. Basis of Design: Parex USA WeatherDry Waterproof Base Coat: (Concrete or Masonry Construction)

1. When LaHabra Fastwall 300 WaterMaster Stucco Assembly is installed over concrete masonry construction, apply a layer of waterproof base coat over the cement plaster base.
2. Allow the cement plaster base to air dry for one day after moist curing before installing.

G. Primer and Finish:

1. Remove surface contaminants such as dust or dirt without damaging the substrate.
2. Ambient and surface temperature must be 40°F or higher during application and drying time. Supplemental heat and protection from precipitation must be provided as needed.
3. Use only on surfaces that are sound, clean, dry, unpainted, and free from any residue that might affect the ability of the finish to bond to the surface.
4. Stucco Assembly
 - a. Before the application of the finish, the base coat must have cured a minimum of 24 hours or longer as required by weather conditions. Examine the cured base coat for any irregularities.
 - b. Correct these irregularities to produce a flat surface.
5. Apply exterior wall finish coats according to product data sheets.
6. Protect Finish Coats from inclement weather until completely dry.

H. Curing

1. Keep cement plaster moist for at least 48 hours (longer in dry weather) by lightly fogging walls. Start light fogging after initial set of 1-2 hours.
2. Air cure acrylic based and elastomeric finish coats only, do not wet cure.

3.05 CLEAN-UP

- A. Removal: Remove and legally dispose of Stucco Assembly component debris material from job site.

3.06 PROTECTION

- A. Provide protection of installed materials from water infiltration into or behind them.

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- B. Provide protection of installed cement plaster from dust, dirt, precipitation, and freezing during installation.
- C. Provide protection of installed finish from dust, dirt, precipitation, freezing and continuous high humidity until fully cured and dry.
- D. Clean exposed surfaces using materials and methods recommended by the manufacturer of the material or product being cleaned. Remove and replace work that cannot be cleaned to the satisfaction of the Project Designer/Owner.

END OF SECTION

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SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior Gypsum Board
2. Exterior, fire-rated gypsum sheathing
3. Tile backing panels for interior wall tile.
4. Metal trim accessories, auxiliary materials, joint treatment, corner guards and skim-coating.

B. Related Requirements:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
2. Section 01 74 19 – Construction Waste Management and Disposal .
3. Section 06 10 00 - Rough Carpentry: Wood framing that supports gypsum board panels.
4. Section 07 21 00 - Building Insulation: Insulation installed in gypsum board assemblies.
5. Section 07 41 13 - Metal Roof Panels - Standing Seam: Roof underlayment.
6. Section 07 92 00 - Joint Sealants: Acoustical sealants installed in gypsum board assemblies.
7. Section 09 30 00 - Tiling: Cement backer board for use under exterior tile and at exterior metal wall covering
8. Section 09 90 00 - Painting: Primers and topcoats applied to gypsum board surfaces.
9. Section 10 26 00 - Wall Protection: Corner and wall end guards.

1.02 REFERENCE STANDARDS

- A. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board 2012, with Editorial Revision (2019).
- B. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2017.

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- C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017.
- D. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing 2003 (Reapproved 2017).
- E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2019b.
- F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2018.
- G. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base 2019.
- H. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.
- I. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel 2018.
- J. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing 2018.
- K. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- L. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels 2019.
- M. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels 2019.
- N. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.
- O. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- P. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- Q. ASTM E413 - Classification for Rating Sound Insulation 2016.
- R. ASTM E1414/E1414M - Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum 2016.
- S. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015.

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- T. GA-216 - Application and Finishing of Gypsum Panel Products 2016.
- U. GA-600 - Fire Resistance Design Manual 2015.
- V. UL (FRD) - Fire Resistance Directory Current Edition.

1.03 SUBMITTALS

- A. Product Data: For each type of product.
- B. CALGreen Submittals:
 - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
- C. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.05 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

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PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
 - b. Mold-resistant board is required for walls and ceilings of unconditioned interior spaces not indicated to receive tile, and for all restroom ceilings.
 - c. Mold-resistant board is required for walls and ceilings of custodial closets.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.02 GYPSUM BOARD, GENERAL

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for requirements for low-emitting materials, Adhesives and Sealants.
- B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.03 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. [Georgia-Pacific Building Products.](#)
 - 2. [National Gypsum Company.](#)
 - 3. [PABCO Gypsum.](#)
 - 4. [United States Gypsum Company.](#)

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5. CertainTeed

C. Gypsum WallBoard:

1. Core: 5/8 inch or as required to flush with adjacent finishes.
2. Long Edges: Tapered.

D. Mold Resistant Paper Faced Products:

1. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard:
www.gpgypsum.com/#sle.
2. National Gypsum Company; Gold Bond 3/4" Ultra-Shield FS XP Gypsum Board:
www.nationalgypsum.com/#sle.
3. USG Corporation; USG Sheetrock Brand EcoSmart Panels Mold Tough Firecode X:
www.usg.com/#sle.

2.04 TILE BACKING PANELS FOR INTERIOR WALL TILE

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation; "GlasRoc Tile Backer."
 - b. Georgia-Pacific Building Products; "DensShield Tile Backer."
 - c. Temple-Inland Building Products by Georgia-Pacific; "GreenGlass Tile Backer"
 - d. Equal.
2. Core: 5/8 inch.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.05 TRIM AND FRAMING ACCESSORIES

A. Typical Interior Trim: ASTM C 1047.

1. Material: Paper-Faced Metal Drywall Bead and Trim. Paper tape laminated to a sturdy, rust-resistant metal form, Coated paper tape flange intended for adhesion by means of joint compound. No nailing is required.
 - a. Manufacturer: USG Beadex® Brand Paper-Faced Metal Drywall Bead and Trim profiles.

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- b. Or equal.
 - 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (control) joint.
 - d. Square-Edge Cornerbead: With notched or flexible flanges.
- B. Resilient Furring Channels: Single or double leg configuration; 1/2 inch channel depth..
 - 1. Products:
 - a. Clark Dietrich; RC Deluxe Resilient Channel: www.clarkdietrich.com/#sle.
 - b. Phillips Manufacturing Co.; RC-2 Resilient Sound Channel: www.phillipsmfg.com/#sle.
- C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - 1. Basis-of-Design Products: The design for aluminum trim accessories is based on products by Fry Reglet Corp.
 - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
 - 3. Finish: Mill finish, with corrosion-resistant primer compatible with joint compound and finish materials specified.

2.06 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Abuse-Resistant Gypsum Board: As recommended by panel manufacturer.
 - 3. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

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1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.07 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 1. Adhesives shall have a VOC_{content} of 50 g/L or less.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
- D. Insulation: As specified in Section 07 21 00 - Building Insulation.
- E. Acoustical Sealant: As specified in Section 07 92 00 - Joint Sealants.
 1. Sealant shall have a VOC_{content} of 250 g/L or less.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except long edges at right angles to framing and in applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

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- I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.03 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws. Do not penetrate board face with screw heads.

B. Sound-Rated Applications:

1. Where partitions are indicated to be sound rated, apply sound damping gypsum board in accordance with manufacturer's published procedures to achieve the rating indicated.
2. Where indicated, install resilient channels in conformance with manufacturer's published installation procedures to achieve the rating indicated.

C. Multilayer Application:

1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
2. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners. Do not penetrate board face with screw heads.

3.04 APPLYING INTERIOR TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Tile Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile, and non-wet locations as indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.

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- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.05 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions. No "mudded-in" trim accessories are acceptable.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Typical Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.
 2. LC-Bead: Use at exposed panel edges.
- D. Aluminum Trim: Install in locations indicated on the drawings.

3.06 FINISHING GYPSUM BOARD

- A. A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
1. Level 0: In areas of temporary construction.
 2. Fire Tape Only: Ceiling plenum areas, concealed areas, and where indicated.
 3. Level 2: Panels that are substrate for tile.
 4. Level 3: Panels that are substrate for wood wall panels and fabric-wrapped wall panels.
 5. Level 4: At panel surfaces in "back-of-house" areas not visible to the public, including staff areas, mechanical spaces, storage rooms, and similar spaces, but excluding panel surfaces that are scheduled to receive paints with semi-gloss or gloss sheen.

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- a. Primer and its application to surfaces are specified in other Division 09 Sections.
- 6. Level 5: At panel surfaces that will be exposed to view unless otherwise indicated; at panel surfaces that are scheduled to receive paints with semi-gloss or gloss sheen; and where otherwise indicated on Drawings.
 - a. Primer and its application to surfaces are specified in other Division 09 Sections.
- E. Tile Backing Panels: Finish according to manufacturer's written instructions.
 - 1. Where exposed, finish according to manufacturer's written instructions for use as exposed board for Finish Level indicated.

3.07 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

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SECTION 09 30 00 - TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for wall applications.
- B. Cementitious backer board for exterior substrate.
- C. Ceramic accessories.
- D. Ceramic trim.
- E. Non-ceramic trim.
- F. Exterior tile assemblies.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 07 27 26 - Sheet-Applied Membrane Air Barriers, Vapor Impermeable: Air barrier at walls to receive exterior tile.
- C. Section 07 62 00 – Sheet Metal flashing and Trim: Exterior sheet metal wall covering.
- D. Section 07 92 00-Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- E. Section 07 92 00-Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- F. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- G. Section 09 29 00 - Gypsum Board: Tile backer board for interior wall tile.
- H. Section 12 36 00 - Countertops: Solid surface, stainless steel, and concrete countertops.
- I. Section 22 30 00 - Plumbing Systems
- J. Section 22 40 00 - Plumbing Fixtures: Sinks, lavatories, and fittings.

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1.03 REFERENCE STANDARDS

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.
- B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.
- C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.
- D. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 1999 (Reaffirmed 2021).
- E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive 2019.
- F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 2020.
- G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy 1999 (Reaffirmed 2019).
- H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2019).
- I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2019).
- J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.
- K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2019).
- M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2021).

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- N. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2012 (Revised).
- O. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).
- P. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).
- Q. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).
- R. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation 2014.
- S. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014.
- T. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar 2012.
- U. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2021.
- V. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products 2018.
- W. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel 2018.
- X. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2021.
- Y. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.
- Z. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

- A. CALGreen Submittals: Provide the following:

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1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
 2. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
 - C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
 - D. Setting and Grouting Systems: Indicate TCNA installation system for each type of tile and setting assembly.
 - E. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.
 - F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
 - G. Installer's Qualification Statement:
 1. Submit documentation of completion of apprenticeship and certification programs.
 - H. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
 - I. Maintenance Materials: Furnish the following for District's use in maintenance of project.
 1. Extra Tile: 1 percent of each size, color, and surface finish combination.

1.06 QUALITY ASSURANCE

- A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.
- B. Installer Qualifications:
 1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

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1.08 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

- A. Manufacturers:
 - 1. Crossville: www.crossville.com.
 - 2. or equal.
- B. Glazed Interior Wall Tile, Type WT1: ANSI A137.1 standard grade.
 - 1. Moisture Absorption: <20.0% percent as tested in accordance with ASTM C373.
 - 2. Size: 4 inch x 12 inch, nominal.
 - 3. Surface Finish: Glazed Satin
 - 4. Color(s): As indicated on drawings..
 - 5. Pattern: Running bond.
 - 6. Trim: Schluter Systems as indicated in the drawings.
 - 7. Trim Units: Matching bullnose and base shapes in sizes coordinated with field tile
 - 8. Products:
 - a. Crossville Corporation; Color by Numbers: www.crossville.com
 - b. or equal.
- C. Porcelain Stone Textured Exterior Tile: ANSI A137.1 standard grade.
 - 1. Moisture Absorption: 0 to 0.2 percent as tested in accordance with ASTM C373.
 - 2. Frost resistant as tested in accordance with ASTM C1026
 - 3. Size: 12 in by 24 in inch, nominal.
 - 4. Thickness: 3/8 inch.

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5. Surface Finish: Unpolished, textured.
6. Color(s): As indicated on drawings.
7. Pattern: Running bond.
8. Products:
 - a. Crossville; Basalt: www.crossville.com.
 - b. or equal.

2.02 TRIM AND ACCESSORIES

- A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
 1. Manufacturers: Same as for tile.
- B. Non-Ceramic Trim: Satin Nickel Anodized Aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
 1. Applications:
 - a. Thresholds at door openings.
 - b. Floor to wall joints.
 2. Manufacturers:
 - a. Schluter-Systems: www.schluter.com/#sle.

2.03 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
 1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
 2. Custom Building Products: www.custombuildingproducts.com/#sle.
 3. LATICRETE International, Inc: www.laticrete.com/#sle.
 4. or equal.
- C. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.

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1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
2. Products:
 - a. ARDEX Engineered Cements; ARDEX X 5: www.ardexamericas.com/#sle.
 - b. Custom Building Products; ProLite Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
 - c. LATICRETE International, Inc[<>]: www.laticrete.com/#sle.
 - d. or equal.

2.04 GROUTS

A. Manufacturers:

1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
2. Custom Building Products: www.custombuildingproducts.com/#sle.
3. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
4. or equal.

B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.

1. Applications: Use this type of grout at walls .
2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
3. Color(s): As selected by Architect from manufacturer's full line.
4. Products:
 - a. ARDEX Engineered Cements; ARDEX FL: www.ardexamericas.com/#sle.
 - b. Custom Building Products; Prism Color Consistent Grout: www.custombuildingproducts.com/#sle.
 - c. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.

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2.05 MAINTENANCE MATERIALS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and plumbing fixtures.
 2. Color(s): As selected by Architect from manufacturer's full line.
 3. Products:
 - a. ARDEX Engineered Cements; ARDEX SX: www.ardexamericas.com/#sle.
 - b. Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com/#sle.
 - c. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.

2.06 ACCESSORY MATERIALS

- A. Waterproofing Membrane for Exterior Tile: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Fluid or Trowel Applied Type:
 - a. Material: Synthetic rubber.
 - b. Thickness: 25 mils, minimum, dry film thickness.
 - c. Products:
 - 1) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
 - 2) Merkrete, by Parex USA, Inc; Merkrete Hydro Guard 2000: www.merkrete.com/#sle.
 - 3) USG Corporation; Durock Brand Liquid Waterproofing Membrane: www.usg.com/#sle.
- B. Exterior Tile Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, thicknesses as indicated on details; 2 inch wide coated glass fiber tape for joints and corners.
1. Products:
 - a. Custom Building Products; WonderBoard Lite Backerboard: www.custombuildingproducts.com/#sle.

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- b. United States Gypsum: USG Durock with Edgeguard: www.usg.com/#sle
- C. Interior Tile Backer Board: See Section 09 29 00 - Gypsum Board.
- D. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Install interior tile backer board in accordance with Section 09 29 00 - Gypsum Board.
- C. Install exterior backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

- A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed or with metal trim as detailed.
- F. Install ceramic accessories rigidly in prepared openings.
- G. Install non-ceramic trim in accordance with manufacturer's instructions.
- H. Keep control and expansion joints free of mortar, grout, and adhesive.
- I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- J. Grout tile joints unless otherwise indicated.

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- K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - WALL TILE

- A. On exterior walls over cementitious backer units on studs, install in accordance with TCNA (HB) Method 244E with sheet applied membrane air barrier..
- B. Over interior coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

3.05 CLEANING

- A. Clean tile and grout surfaces.

END OF SECTION

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SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acoustical panel ceilings, adhesive-applied.

1.02 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 74 19 - Construction Waste Management and Disposal.
- C. Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- D. Section 09 29 00 - Gypsum Board.
- E. Section 09 90 00 - Painting: Field painting of acoustical panel ceilings.
- F. Division 21: Sprinkler heads in acoustical ceilings.
- G. Division 23: Grilles, registers, and diffusers in acoustical ceilings.
- H. Division 26: Lighting fixtures in acoustical ceilings.

1.03 ACTION SUBMITTALS

- A. CALGreen Submittals: Provide the following:
 - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
 - 2. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- B. Product Data: For each type of product indicated, including the following:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

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- C. Shop Drawings: Submit reflected ceiling plans on which the following items are shown and coordinated with each other for the fabrication and installation of the Work, based on input from installers of the items involved for Architect's action.
 - 1. Method of attachment to building structure.
 - 2. Change in level details.
- D. Samples for Verification: Submit samples of each type of exposed finish required, prepared on samples of size indicated below and of same thickness and material indicated for final unit of Work.
 - 1. Ceiling Panels: Samples of each acoustical panel type, pattern, and color; 6" x 6" minimum.

1.04 INFORMATIONAL SUBMITTALS

- A. CALGreen Submittals: Provide product data for the following:
 - 1. Product Data for CALGreen 5.504.4.1 - Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical ceiling units, permit them to reach room temperature and stabilized moisture content.
- C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

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1.08 PROJECT CONDITIONS

- A. Install acoustical units after interior wet work is dry.

PART 2 PRODUCTS

2.01 MATERIAL REQUIREMENTS, GENERAL

- A. VOC Content: Sealants applied on-site on the interior of the building and products used on the interior of the building shall comply with VOC limits as specified in Section 01 81 13 - Sustainable Design Requirements for low-emitting materials.

2.02 MANUFACTURERS

- A. Basis-of-Design Product: The design for the acoustical panel ceiling systems is based on the manufacturer identified below. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
 - 1. Basis-of-Design: Armstrong World Industries, Inc.
 - 2. United States Gypsum, USG Interiors
 - 3. Certainteed.

2.03 MATERIALS

- A. Ceiling Panel (ACT-1): Armstrong World Industries, Invisacoustics
 - 1. Item Number: 1212WH
 - 2. Size: 24 x 48
 - 3. Thickness: 3/4"
 - 4. Composition: Mineral fiber
 - 5. Edge Profile:
 - a. 48 inch edge: Square
 - b. 24 inch edge: Back-cut for visual notch approximately 3/8-inch x 7/8 inch.
 - 6. NRC: 0.75.
 - 7. CAC: N/A
 - 8. Surface Color: White.

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9. Surface Finish: Factory-applied latex paint; compatible with field-applied paint specified in Section 09 90 00 - Painting.

2.04 ADHESIVE

- A. Refer to Section 01 81 13 - Sustainable Design Requirements for requirements for low-emitting materials for adhesives, sealants, and caulks used on the project.
- B. Acceptable Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Titebond GREENchoice Acoustical Ceiling Tile Adhesive

2.05 ACOUSTICAL SEALANT

- A. Refer to Section 01 81 13 - Sustainable Design Requirements for requirements for low-emitting materials for adhesives, sealants, and caulks used on the project.
- B. Acceptable Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- C. Acceptable Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.

2.06 ADHESIVE-APPLIED CEILING SYSTEM

- A. Install acoustical material in accordance with manufacturer's instructions.
- B. Lay work out symmetrically about centers of rooms and provide symmetrical borders not less than half size of tile specified unless noted otherwise on the Drawings.
- C. Make penetrations through ceiling panels in such a manner to ensure tight fit and neat appearance. Center penetrations in tile unless otherwise noted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and attachment and with

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requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.
- B. Locate system on room axis according to reflected ceiling plan.

3.03 INSTALLATION, ACOUSTICAL PANELS

- A. Install acoustical panels in accordance with manufacturer's written instructions.
- B. Fit adjoining panels to form nominal 1/4 inch (6 mm) reveal joints. Scribe and cut panels for accurate fit at perimeter and around penetrations.
- C. Apply adhesive with notched trowel. Press panels into place snug to under surface of roof sheathing, over any protruding roof system fasteners.

3.04 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings. Comply with manufacturer's 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.
- B. Construction Waste Management: Manage construction waste in accordance with provisions of Section 01 74 19 Construction Waste Management and Disposal.

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SECTION 09 65 00 - RESILIENT FLOORING & BASE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Resilient base.
- C. Installation accessories.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials and floor finish materials.
- C. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.
- D. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- E. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

- A. ASTM D6866 - Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
- C. ASTM F1344 - Standard Specification for Rubber Floor Tile 2021a.
- D. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.
- E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2019.
- F. RFCI - Resilient Floor Covering Institute FloorScore Program

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1.04 SUBMITTALS

- A. See Division 01 for submittal procedures.
- B. CALGreen Submittals:
 - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content.
 - 2. Product Data for CALGreen 5.504.4.6 – Finish Material Pollutant Control; Resilient Flooring Systems: For resilient tile flooring, documentation indicating certification under the Resilient Floor Covering Institute (RFCI) FloorScore program.
- C. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- D. Verification Samples: Submit two samples, 3 by 3 inch in size illustrating color and pattern for each resilient flooring product specified.
- E. Sustainable Design Submittal: Submit VOC content documentation for flooring and adhesives.
- F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- G. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.
- J. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- K. Maintenance Materials: Furnish the following for District's use in maintenance of project.
 - 1. Refer to Division 1 for additional provisions.
 - 2. Extra Flooring Material: 10 square feet of each type and color.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum ten years documented experience.

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- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Do not double stack pallets.

1.07 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 MATERIAL REQUIREMENTS, GENERAL

- A. Resilient flooring systems. For 80 percent of floor area receiving resilient flooring, installed resilient flooring shall meet at least one of the following :
 - 1. Certified under the Resilient Floor Covering Institute (RFCI) FloorScore program;
 - 2. Compliant with the VOC-emission limits and testing requirements specified in the California Department of Public Health's 2010 Standard Method for the Testing and Evaluation Chambers, Version 1.1, February 2010;
 - 3. Compliant with the Collaborative for High Performance Schools California (CA-CHPS) Criteria Interpretation for EQ 7.0 and EQ 7.1 (formerly EQ 2.2) dated July 2012 and listed in the CHPS High Performance Product Database; or
 - 4. Products certified under the UL GREENGUARD Gold (formerly the Greenguard Children & Schools program).
- B. Adhesives: All leveling compounds, adhesives and sealers shall meet the requirements of Table 5.504.4.1.
- C. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for floor finishes and low-emitting materials.

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2.02 TILE FLOORING

- A. Rubber Tile: Homogeneous, color and pattern throughout thickness.
1. Manufacturers:
 - a. Mannington Commercial; Teles.
 2. Minimum Requirements: Comply with ASTM F1344, of Class corresponding to type specified.
 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 4. Size: 24 by 24 inch nominal.
 5. Total Thickness: 0.80 inch.
 6. Texture: Smooth.
 7. Color: As indicated on drawings, selected from manufacturer's full range of colors

2.03 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TP, rubber, thermoplastic; Style B, Cove.
1. Manufacturers:
 - a. Burke Flooring; Commercial Wall Base - TP: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - c. Roppe Corp: www.roppe.com/#sle.
 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 3. Height: 4 inch.
 4. Thickness: 0.125 inch.
 5. Finish: Matte.
 6. Length: Roll.
 7. Color: As indicated on drawings.
 8. Accessories: Premolded external corners and internal corners.

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2.04 ACCESSORIES

- A. Subfloor Filler: Type recommended by flooring material manufacturer and in accordance with Section 09 05 61 - Common Results for Flooring Preparation.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Moldings, Transition and Edge Strips: Resilient.
 - 1. Manufacturers:
 - a. Burke Flooring: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test in accordance with Section 09 05 61.
 - 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
 - 3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.

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C. Adhesive-Applied Installation:

1. Fit joints and butt seams tightly.
2. Set flooring in place, press with heavy roller to attain full adhesion.

D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

1. Resilient Strips: Attach to substrate using adhesive.

E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

F. Install flooring in recessed floor access covers, maintaining floor pattern.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

C. Install square tile to ashlar pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

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3.07 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

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SECTION 09 67 00 - FLUID-APPLIED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fluid-applied flooring.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- C. Section 07 92 00 - Joint Sealants: Sealing joints between fluid-applied flooring and adjacent construction and fixtures.
- D. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- E. Section 09 30 00 - Tiling: Wall tile.
- F. Division 22: Floor drains.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. CALGreen Submittals: Provide the following:
 - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
 - 2. Product Data for CALGreen 5.504.4.3 – Finish Material Pollutant Control; Architectural paints and coatings, including printed statement of VOC content and chemical components.
- C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- D. Samples: Submit two samples, 6 by 6 inch in size illustrating color and pattern for each floor material for each color specified.

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- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Manufacturer's Installation Instructions: Indicate special procedures.
- G. Manufacturer's Qualification Statement.
- H. Applicator's Qualification Statement.
- I. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section.
 - 1. Minimum 3 years of documented experience.
 - 2. Approved by manufacturer.
- C. Supervisor Qualifications: Trained by product manufacturer , under direct full time supervision of manufacturer's own foreman.

1.06 MOCK-UP

- A. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture and workmanship.
 - 1. Number of Mock-Ups to be Prepared: One.
 - 2. Use same materials and methods for use in the work.
 - 3. Locate where directed.
 - 4. Minimum Size: 48 inches by 48 inches.
- B. Obtain approval of mock-up by Architect before proceeding with work.
- C. Approved mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store resin materials in a dry, secure area.

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- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.08 FIELD CONDITIONS

- A. Maintain minimum temperature in storage area of 55 degrees F.
- B. Store materials in area of installation for minimum period of 24 hours prior to installation.
- C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials, Architectural Paints and Coatings.

2.02 MANUFACTURERS

- A. Fluid-Applied Flooring:
1. Stonhard Inc.: www.stonhard.com/#sle.
 2. PPG Paints Megaseal Fluid Applied Flooring: www.ppgpaints.com/#sle and www.ppgpmc.com/home.aspx/#sle.
 3. Sherwin-Williams Company: www.protective.sherwin-williams.com/#sle.
 4. Sika Corporation: www.sikafloorusa.com/#sle.

2.03 FLUID-APPLIED FLOORING SYSTEMS

- A. Fluid-Applied Flooring: Multi-coat slip-resistant system consisting of epoxy base coats, quartz aggregates, and epoxy top coat.
- B. Basis of Design Product: Stonhard Inc; Stoneshield SLT.
- C. System Characteristics:
1. Color and Pattern: As selected from Manufacturer's. Standards
 2. Wearing Surface: Standard.
 3. Overall System Thickness: nominal 2mm.

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D. System Components: Manufacturer's standard components that are compatible with each other and as follows:

1. Primer:
 - a. Material Basis: Stonhard Standard Primer
 - b. Resin: Epoxy
2. Sealer
 - a. Material Basis: Stonkote CE4.
 - b. Resin: Epoxy
 - c. Formulation Description: (2) two-component, 100% solids, UV Stable.
 - d. Type: Clear.
 - e. Finish: Gloss.
 - f. Number of Coats: one.
 - g. Texture level: Standard or medium.

E. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Tensile Strength: 1,600 psi per ASTM C307
2. Flexural Strength: 4,000 psi per ASTM C580
3. Flexural Modulus of Elasticity: 1.0×10^6 psi per ASTM C580
4. Hardness: 85 to 90 per ASTM D2240, Shore D
5. Impact Resistance: > 160 in./lbs. per ASTM D2794
6. Abrasion Resistance: 0.06 gm max. weight loss per ASTM D 4060, CS-17
7. Flammability: Class 1 per ASTM E-648.
8. Thermal Coefficient of Linear Expansion: 1.4×10^{-5} in./in. °F
9. Water Absorption: 0.1% per ASTM C 413
10. VOC Content per ASTM D2369:

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- a. Stonshield Undercoat – 34 g/l
 - b. Stonkote CE4 – 34 g/l
- 11. Cure Rate @ 77°F/25°C: 12 hours foot traffic, 24 hours normal operations
- 12. Formulation Description: (2) two component, 100 percent solids.
- 13. Application Method: Squeegee and roller.
- 14. Number of Coats: (1) one.
- 15. Broadcast Media:
 - a. Material Basis: Stonshield quartz aggregate.
 - b. Type: pigmented.
 - c. Finish: standard.
 - d. Number of Coats: one.
 - e. Pattern: Tweed.
- 16. Undercoat:
 - a. Material Basis: Stonshield undercoat.
 - b. Resin: Epoxy
 - c. Formulation Description: (2) two-component, 100% solids, UV Stable.
 - d. Type: Clear.
 - e. Finish: Gloss.
 - f. Number of Coats: one.
- 17. Broadcast Media:
 - a. Material Basis: Stonshield quartz aggregate
 - b. Type: pigmented.
 - c. Finish: standard.
 - d. Number of Coats: one.
 - e. Pattern: Tweed.

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2.04 ACCESSORIES

- A. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.
- B. Primer: Type recommended by fluid-applied flooring manufacturer.
- C. Sealer: Manufacturer's recommended product for application at slab control joints; Stonflex MP7 joint fill material.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall and subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test in accordance with Section 09 05 61, and flooring system manufacturer's published recommendations.
 - 2. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.
 - 3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.
- C. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.
- D. Vacuum clean substrate.
- E. Apply primer to surfaces required by flooring manufacturer.

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- F. Chase edges to "lock" the flooring system into the concrete substrate along lines of termination.
- G. Penetration Treatment: Lap and seal resinous system onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

3.03 INSTALLATION - FLOORING

- A. Apply in accordance with manufacturer's instructions.
- B. Apply each coat to minimum thickness required by manufacturer.
- C. Finish to smooth level surface.
- D. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.

3.04 FIELD QUALITY CONTROL

- A. Refer to Division 1 for additional requirements.

3.05 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Barricade area to protect flooring until fully cured.

END OF SECTION

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SECTION 09 90 00 - PAINTING

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes surface preparation and field painting and finishing of exposed exterior and interior items and surfaces.

1.02 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections:
1. Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
 2. Section 04 22 00 - Concrete Unit Masonry: Integral water repellent in unit masonry.
 3. Division 05: Shop priming or shop finishing of metal fabrications as specified.
 4. Section 06 20 00 - Finish Carpentry: Shop finishing of interior woodwork.
 5. Section 07 46 46 - Fiber-Cement Panels: Factory priming of soffit panels.
 6. Section 07 46 49 - Poly-Ash Siding and Trim: Factory priming of siding.
 7. Section 07 92 00 - Joint Sealants.
 8. Section 08 14 16 - Flush Wood Doors: Shop priming of flush wood doors.
 9. Section 08 16 13 - Fiberglass Doors: Factory finishing of fiberglass doors.
 10. Section 08 36 13 - Sectional Doors: Factory finishing of sectional doors.
 11. Section 09 24 00 - Portland Cement Plaster: Integrally colored plaster finish coat.
 12. Section 09 29 00 - Gypsum Board: Finish levels for gypsum board.

1.03 SYSTEM DESCRIPTION

- A. "Paint": As used herein, means coating systems materials including primers, emulsions, epoxy, enamels, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats (Refer to ASTM D16).

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- B. Painting and coating products must comply with Green Seal standards in accordance with EPA Reference Test Method 24 and CFR Title 40, Part 60, Appendix A.
- C. Paint exposed surfaces whether or not colors are designated, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
 - 1. Prepare, prime, and paint existing and new surface-mounted electrical raceway covers, including plastic and metal covers.
- D. Surfaces Not to be Painted:
 - 1. Exterior cast-in-place concrete and concrete masonry unless otherwise indicated.
 - 2. Stainless-steel fabrications.
 - 3. Exposed galvanized steel fabrications, including exterior backsplash panels, corner guards, gates and galvanized gate infill panels.
 - 4. Factory-finished items specified in various Sections.
 - 5. Prefinished items and floor coverings.
 - 6. Painting specified elsewhere and included in respective Sections, including but not necessarily limited to, shop priming.
 - 7. Code-Required Labels: Keep equipment identification and fire rating labels free of paint.
 - 8. Surfaces concealed in walls and above ceilings except as specifically indicated otherwise.
 - 9. Ducts, piping, conduit, and equipment concealed in walls and ceilings, unless specifically indicated otherwise.

1.04 REFERENCES

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.
- B. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- C. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2008.

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- D. EN 15804 - Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products; 2013.
- E. ISO 14025 - Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures; 2006.
- F. ISO 14040 - Environmental management -- Life cycle assessment -- Principles and framework; 2006.
- G. ISO 14044 - Environmental management -- Life cycle assessment -- Requirements and guidelines; 2006.
- H. ISO 21930 - Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services; 2017.
- I. SCAQMD Rule 1113 - Architectural Coatings; 1977 (Amended 2016).
- J. SSPC-SP 6 - Commercial Blast Cleaning; 2007.
- K. SSPC-SP 10 - Near-White Blast Cleaning; 2007.
- L. CFR - Code of Federal Regulations Title 40, Part 60 - Protection of Environment, Standards of Performance for New Stationary Sources.
- M. Factory Mutual - FM Certification of intumescent paint.
- N. Green Seal - GS 11 Green Seal Standard for Paints, Coatings, Stains and Sealers.
- O. Green Seal - GC-03 Green Seal Standard for Anti-Corrosive Paints.
- P. USGBC LEED - LEED v4.1 Green Building Rating System for [New Construction and Major Renovation.
- Q. UL - Underwriters Laboratories Inc. - UL Spot clearinghouse for standards, certifications and Environmental Product Declarations.

1.05 SUBMITTALS

A. CALGreen Submittals:

- 1. Product Data for CALGreen 5.504.4.3 - Finish Material Pollutant Control, Paints and Coatings: Product data and material safety data sheets (MSDS) for coatings, including printed statement of chemical composition and VOC content of each product used.
- 2. Product Data Sheets for each product to be used as proof that each product meets the requirements of either Green Seal's GS-11 or GC-03 documents.

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3. Field Verification of on-site product containers: If required by Authority Having Jurisdiction.
- B. Product Data: For each product indicated including primers.
1. Provide manufacturer's technical information including label analysis and instructions for handling, storage, and application of each material proposed for use.
 2. List each material and cross reference the specific coating, finish system, and application. Identify each material by the manufacturer's catalog number and general classification.
- C. Samples: For each type of paint system and in each color and gloss of topcoat indicated.
1. Submit Samples on rigid backing, 8-1/2 inches by 11 inches.
 2. Step coats on Samples to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
 5. Do not commence finish painting until approved samples are on file at the job site.

1.06 QUALITY ASSURANCE

- A. Applicator's Qualifications, General: Engage an experienced applicator who has completed painting system applications similar in material and extent.
- B. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use thinners approved by paint manufacturer, and use within recommended limits.
- C. Coordination of Work: Review other Sections in which prime paints are to be provided to ensure compatibility of coatings system for various substrates. Upon request, furnish information or characteristics of finish materials to be used.
- D. Requirements of Regulatory Agencies: Comply with applicable rules and regulations of governing agencies for air quality control.
 1. CALGreen: Comply with current applicable regulations of the local air quality district, California Air Resources Board (CARB).
 2. Regulatory changes may affect the formulation, availability, or use of specified coatings. Confirm availability of coatings to be used prior to start of painting.
- E. Benchmark Samples (Mockups):

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1. Provide a full-coat benchmark finish sample for each type of coating and substrate required until required sheen, color and texture is obtained. Simulate finished lighting conditions for review of in-place work.
2. Final colors to be approved by the Architect after a maximum of 3 adjustments to each color at no additional cost.
3. Poly-Ash Siding: Provide samples on full width siding boards at least 8 ft. in length. Apply over factory-primed surface utilizing proposed application method. Final color to be approved by the Architect after a maximum of 2 adjustments at no additional cost.
4. Wood specified to receive stain finishes: Provide samples on full width boards at least 8 ft. in length. Apply over prepared surface utilizing proposed application method. Final color to be approved by the Architect after a maximum of 2 adjustments at no additional cost.
5. Wall Surfaces: Provide samples at least 100 sq. ft. in area. Apply over specified undercoat utilizing proposed application method for each type of finish.
6. Accent Wall Colors: Paint 3-feet by 5-feet mockup of each accent wall color on wall indicated on finish plan. Paint colors provided in the mockups shall indicate approximate color ranges. Final colors to be approved by the Architect after a maximum of 2 adjustments to each color at no additional cost.
7. Small Areas and Items: Architect will designate items or areas required.
8. Final approval of colors will be from benchmark samples.

1.07 PROJECT CONDITIONS

- A. Acceptance at Site: Deliver materials to the job site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 1. Product name or title of material.
 2. Product description (generic classification or binder type).
 3. Manufacturer's stock number and date of manufacture.
 4. Contents by volume for pigment and vehicle constituents.
 5. Thinning instructions.
 6. Application instructions.
 7. Color name and number

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- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.
- C. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.
- D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Notify Architect of any existing deteriorated or defective conditions prior to painting and in a timely manner as to not affect the schedule.
- F. Provide barrier coats over incompatible primers or remove and reprime.
- G. Visually inspect existing exterior and interior sealant at locations listed below and all other locations where it has been installed. Remove and correct deteriorated sealant. Refer to Section 07 92 00.
 - 1. Exterior: Perimeter of door and window openings, flashing, and control joints.
 - 2. Interior: Perimeter of door and window openings and casework.
- H. Notify Architect of any existing deteriorated or defective conditions prior to painting, in a timely manner as to not affect the schedule. Do not proceed until unsatisfactory conditions are corrected.

1.08 EXTRA MATERIALS

- A. Upon completion of the work of this Section, remove excess material from the site. No attic stock is required

PART 2 - PRODUCTS

2.01 SUSTAINABLE MATERIAL REQUIREMENTS

- A. CALGreen: Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control Measure, as shown in Table 5.504.4.3, unless more stringent local limits apply. The VOC content limit for coatings that do not meet the definitions for the specialty coatings categories listed in Table 5.504.4.3, shall be determined by classifying the coating as a Flat, Nonflat, or Nonflat-High Gloss coating, based on its gloss, as defined in Subsections 4.21, 4.36 and 4.37 of the 2007 California Air Resources Board, Suggested Control Measure, and the corresponding Flat, Nonflat or Nonflat-High Gloss VOC limit in Table 5.504.4.3 shall apply.

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- B. Aerosol paints and coatings. Aerosol paints and coatings shall meet the PWMIR Limits for VOC in Section 94522(a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, in Sections 94522(c)(2) and (d)(2) of California Code of Regulations, Title 17, commencing with Section 94520; and in areas under the jurisdiction of the Bay Area Air Quality Management District additionally comply with the percent VOC by weight of product limits of Regulation 8 Rule 49.
- C. Refer to Section 01 81 13 - Sustainable Design Requirements for low-emitting materials requirements.

2.02 MANUFACTURERS

- A. Owner's Standards Program: Where applicable, provide products under the terms and conditions of the Owner's standards program; no substitutions.
- B. Manufacturers: Products of the following manufacturers are listed in other Part 2 articles and use the abbreviated names shown in parentheses:
 - 1. Benjamin Moore & Co. (Benjamin Moore).
 - 2. Devoe
 - 3. Duckback Products, Inc. (Duckback).
 - 4. Dunn - Edwards Corporation (Dunn - Edwards).
 - 5. PPG Paints.
 - 6. Samuel Cabot, Inc. (Cabot).
 - 7. Sherwin-Williams Co., The (Sherwin-Williams).
 - 8. Tnemec Company, Inc. (Tnemec).
 - 9. Thermory USA. (Thermory)
 - 10. Timber Pro
 - 11. Zinsser
- C. Subject to compliance with requirements, provide the named products or comparable products by an accepted equal manufacturer.

2.03 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide primers and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application,

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as demonstrated by manufacturer based on testing and field experience.

- B. Material Quality: Provide manufacturer's top-of-the-line-quality paint 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.
- C. Colors:
 - 1. Exterior Colors: To be selected.
 - 2. Interior Colors: To be selected.

2.04 PREPARATORY COATS

- A. Crack Fillers: Factory-formulated acrylic emulsion crack fillers compatible with substrate and finish-coat materials indicated.
- B. Typical Exterior Primers: Exterior latex-based primers of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.
 - 1. Ferrous-Metal, Zinc-Coated Metal, and Aluminum Substrates NOT Indicated to Receive High Performance Coating: Rust-inhibitive acrylic metal primer.
 - a. Benjamin Moore; P04 Super Spec HP.
 - b. Dunn - Edwards; BLPR00 BLOC-RUST or ULGM00 Ultrashield Galvanized Metal
 - c. Sherwin-Williams; B66-310 ProCryl Universal Metal Primer.
 - d. PPG Pitt-Tech Plus Direct to Metal Primer & Flat Finish 4020PF
 - 2. Ferrous-Metal, Zinc-Coated Metal, and Aluminum Substrates Indicated to Receive High Performance Coating: Rust-inhibitive low-VOC epoxy primer manufactured by same manufacturer and compatible with high performance coating system.
 - a. Tnemec, L69.
 - b. Devoe, Devran 203.
 - c. PPG, Amercoat 68HS.
 - 3. Wood Substrates indicated to receive semi-transparent or semi-solid stain finish.
 - a. No primer required.
 - 4. Poly-Ash Siding and Trim; Fiber-Cement Panels.

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- a. Factory primed.
- C. Typical Interior Primers: Interior latex-based primers of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.
 - 1. Gypsum Board Substrates: Zero VOC primer/sealer.
 - a. Benjamin Moore; 372 Eco Spec WB.
 - b. Dunn - Edwards; VNSL00 Vinylastic Select.
 - c. Sherwin-Williams; B28 ProMar 200 Zero.
 - 2. Ferrous-Metal, Zinc-Coated Metal, and Aluminum Substrates: Rust-inhibitive acrylic metal primer.
 - a. Benjamin Moore; P04 Super Spec HP.
 - b. Dunn - Edwards; BLPR00 BLOC-RUST or ULGM00 Ultrashield Galvanized Metal.
 - c. Sherwin-Williams; B66-310 ProCryl Universal Metal Primer.
 - d. PPG Pitt-Tech Plus Direct to Metal Primer & Flat Finish 4020 PF.
 - 3. Wood Substrates for Opaque Finish (Smooth or Synthetic): Acrylic stain blocking primer.
 - a. Benjamin Moore; 046 Fresh Start.
 - b. Dunn - Edwards; BIPR00 BLOCK-IT.
 - 4. Exterior Wood Substrates: To receive stain finishes.
 - a. Preparatory Coats: Follow stain manufacturer's published recommendations.
 - b. Primer: Not required

2.05 EXTERIOR FINISH COATS

- A. Exterior Flat Acrylic Paint (fiber cement soffit panels):
 - 1. Benjamin Moore; 105 MoorLife.
 - 2. Dunn - Edwards; EVSH10 Evershield.
 - 3. Sherwin-Williams; K32 Duration Flat.
- B. Exterior Low-Luster Acrylic Enamel:

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1. Benjamin Moore; 103 MoorGuard.
 2. Dunn - Edwards; EVSH30 Evershield.
 3. Sherwin-Williams; K33 Duration Satin.
- C. Exterior Semi-Gloss Acrylic Enamel:
1. Benjamin Moore; 096 MoorGlo.
 2. Dunn - Edwards; EVSH50-0 Evershield.
 3. Sherwin-Williams; K34 Duration Gloss.
- D. Exterior High Performance Topcoats (exterior exposed steel structural framing) :
1. Intermediate Coat: Epoxy intermediate coat as recommended by manufacturer for intended applications.
 2. Topcoats: Semi-gloss, acrylic polyurethane enamel.
 - a. Devoe; Devthane 378H.
 - b. PCI; PC3v100.
 - c. Tnemec; Series 1075 Endurashield.
 - d. PPG PMC Amershield VOC Aliphatic Polyurethane Coating.
 - e. US Coatings; UreGrip 3310VOC
 3. OPTION to provide Polysiloxane High Performance Coating system:
 - a. PPG Paints Amercoat 68HS Zinc Rich Primer. 2-5 mils DFT.
 - b. PPG Paints PSX-805 Polysiloxane Satin Finish 3-6 mils DFT.
- E. Exterior Semi-Transparent Wood Stain Finish (exposed structural framing; gate infill panels):
1. For Semi-Transparent Wood Finish: Exterior waterborne wood stain.
 - a. Basis of Design:
 - 1) Cabot; Semi-Transparent Acrylic Siding Stain 1300 Series: VOC<100g/L; approximately 25% solids by volume.
 - b. Acceptable Products:

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- 1) Duckback; Superdeck Semi-Transparent Waterborne Stain, 2400 Series.
- 2) Sherwin-Williams; Superdeck Semi-Transparent Acrylic Stain.

F. Exterior Semi-Solid Wood Stain Finish (Poly-Ash Siding and Trim):

1. For Semi-Solid Wood Finish: Exterior penetrating natural linseed oil-based low VOC wood stain.
 - a. Basis of Design:
 - 1) Cabot; Semi-Solid Penetrating Deck and Siding Stain 17406 Series: VOC<250g/L; approximately 20% solids by volume.

G. Exterior Wood Finish for Benches

1. Waterborne transparent finish.
 - a. Cleaner/Neutralizer; Thermory Cutek Quickclean.
 - b. Penetrating Wood Stabilizer; Thermory Cutek Extreme.

2.06 INTERIOR FINISH COATS

A. Interior Flat Zero VOC/Low Odor Acrylic Paint (acoustic ceiling panels and exposed interior roof structure):

1. Benjamin Moore; 373 Eco Spec WB.
2. Dunn-Edwards; SZRO10.
3. Sherwin-Williams; B05 Harmony Flat.

B. Interior Low-Sheen (Eggshell) Zero VOC/Low Odor Acrylic Enamel:

1. Benjamin Moore; 374 Eco Spec WB.
2. Dunn-Edwards; SWLL30.
3. Sherwin-Williams; B09 Harmony Eggshell.

C. Interior Semi-gloss Zero VOC/Low Odor Acrylic Enamel:

1. Benjamin Moore; 376 Eco Spec WB.
2. Dunn-Edwards; SWLL50.
3. Sherwin-Williams; B10 Harmony Gloss.

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D. Interior Wood Bio-Based Stain Finish:

1. Bio-based oil wood stain: Timber Pro; Log & Siding Formula, Smooth
2. Sealer: Timber Pro Crystal Urethane Interior waterborne sealer.

E. Interior Satin Wood Varnish: Waterborne, acrylic/urethane. Finish coat for relocated hardwood casework and wood countertops.

1. Gemini; HPURE-0030 HYDROPURE Clear Urethane Satin Finish.
2. Rust-Oleum; Varathane Diamond 2002.
3. Sherwin-Williams; Minwax Polyurethane Varnish Satin.
4. PPG Deft Clear Polyurethane Interior Water Based Acrylic Satin DFT159.

PART 3 - EXECUTION

3.01 APPLICATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.

B. Quality Control

1. Touch-up shop-applied prime coats which have been damaged, and touch-up bare areas prior to start of finish coats application.
2. Slightly vary the color of succeeding coats.
 - a. Do not apply additional coats until the completed coat has been inspected and approved.
 - b. Only the inspected and approved coats of paint will be considered in determining the number of coats applied.
3. Sand and dust between coats to remove defects visible to the unaided eye from a distance of 5 feet.

C. Drying

1. Allow sufficient drying time between coats, modifying the period as recommended by the material manufacturer to suite adverse weather conditions.
2. Consider paint as dry for re-coating when the paint feels firm; does not deform or feel sticky under moderate pressure of the thumb, and when the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

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3. Protect newly painted surfaces from contact with door seals and similar compressible materials that may adhere to paint and peel it.
- D. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
- E. Remove factory-finished hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- F. Factory primed hardware
1. Paint prime coated hardware to match adjacent surfaces.
 2. Paint metal portions of head seals, jamb seals, and astragal seals to match the color of the door frame unless otherwise directed by the Architect.
- G. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and reprime.
 2. Gypsum Board: Refer to Section 09 29 00 - Gypsum Board for finishing of new surfaces. Allow to dry completely before priming.
 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - b. Prime or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides.
 - c. Rough Sawn Wood Surfaces Exposed to View: Fill holes and defects. Lightly sand but maintain rough sawn appearance to match existing.

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- d. Unless specifically approved by the Architect, do not proceed with painting of wood surfaces until the moisture content of the wood is 12 percent or less as measured by a moisture meter approved by the Architect.
 4. Relocated hardwood cabinets and countertops, previously finished: Repair gouges and similar damage with wood filler tinted to match existing finish. Clean and lightly sand all exposed cabinet and countertop surfaces, including interior face of doors and drawers. Apply one coat transparent polyurethane finish.
 5. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
 6. Galvanized Surfaces: Where galvanized surfaces are indicated to receive paint, clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- H. Material Preparation:
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
- I. Exposed Surfaces: Include areas visible when permanent or built-in fixtures, grilles, convactor covers, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
1. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 2. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 3. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 4. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

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5. Paint all gypsum board ceiling, wall, and soffit surfaces above ceilings which can be viewed through open or "gapped" ceiling systems.
- J. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brush Applications
 - a. Brush out and work the brush coats onto the surface in an even film.
 - b. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.
 2. Spray Application
 - a. Except as specifically otherwise approved by the Architect, confine spray application to metal framework and similar surfaces where hand brush work would be inferior.
 - b. Where spray application is used, apply each coat to provide the hiding equivalent of brush coats.
 - c. Do not double back with spray equipment to build up film thickness of 2 coats in 1 pass.
 - d. Protect all adjacent surfaces, etc. from over spray.
 3. Rough Sawn Wood: Back roll and back brush for a uniform finish.
- K. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.
1. Slightly vary the color of succeeding coats.
 2. Do not apply additional coats until the completed coat has been inspected and approved.
 3. Only the inspected and approved coats of paint will be considered in determining the number of coats applied.
- L. Exposed Mechanical and Electrical Items: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
1. Finish electric panels, access doors, conduits, pipes, ducts, grilles, registers, vents, and items of similar nature to match the adjacent wall and ceiling surfaces, or as directed.

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2. Paint visible duct surfaces behind vents, registers, and grilles flat black. Apply 2 coats of heat resistant paint.
3. Exposed Pipe and Duct Insulation
 - a. Apply 1 coat of latex paint on insulation which has been sized or primed under other Sections; apply 2 coats on such surfaces when unprepared.
 - b. Match color of adjacent surfaces.
 - c. Remove band before painting, and replace after painting.
- M. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
- N. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
 1. Omit primer over metal surfaces that have been shop primed and touchup painted.
- O. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
 1. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.

3.02 CLEANING AND PROTECTING

- A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
- B. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- C. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

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3.03 WASTE MANAGEMENT

- A. Set aside extra paint for future color matches, or reuse by Owner. Where paint recycling is available, collect all waste paint by type and provide for delivery to recycling or collection facility.
- B. Close and seal tightly all partly used paint and finish containers and store protected in well ventilated fire-safe area at moderate temperature.
- C. Place empty containers of solvent based paints in areas designated for hazardous materials.
- D. Do not dispose of paints or solvents by pouring on the ground. Place in designated containers for proper disposal.

3.04 EXTERIOR PAINT SCHEDULE

- A. Metal Doors and Frames, and Other Non-Prefinished Miscellaneous Metal:
 - 1. Ferrous Metal:
 - a. Acrylic Finish: Two finish coats over a primer.
 - 1) Primer: Exterior primer as specified for substrate indicated (not required on shop-primed items).
 - 2) Finish Coats: Exterior semi-gloss acrylic enamel.
 - 2. Zinc-Coated Metal:
 - a. Acrylic Finish: Two finish coats over a primer.
 - 1) Primer: Exterior primer as specified for substrate indicated (not required on shop-primed items).
 - 2) Finish Coats: Exterior semi-gloss acrylic enamel.
- B. Exposed structural steel, and items noted on drawings to receive High-Performance Coating:
 - 1. Exterior High-Performance Finish: Two finish coats over primer.
 - a. Primer: Low VOC epoxy primer shop-applied in applicable Division 05 Section.
 - b. Intermediate Coat: Epoxy intermediate coat as recommended by manufacturer of high-performance topcoat for intended application.
 - c. Topcoat: Semi-gloss acrylic polyurethane.

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C. Miscellaneous wood trim indicated to receive opaque (paint) finish:

1. Surfaces to receive Flat Finish:

- a. General: Acrylic finish, two finish coats over a primer.
- b. Primer: Exterior zero VOC/low odor primer as specified for substrate indicated.
- c. Finish Coats: Exterior low-sheen, VOC/low odor acrylic paint.

D. Wood breezway soffit, gate infill panels, and miscellaneous wood indicated to receive semi-transparent stain finish:

1. Surfaces to receive Stain Finish:

- a. General: Semi-Transparent stain finish.
- b. Finish Coats: Exterior low-sheen, VOC/low odor stain.

E. Poly-Ash composite siding and trim:

1. Surfaces to receive Penetrating Stain Finish:

- a. General: Semi-Solid stain finish over pre-primed composite material:
- b. Finish Coats: Exterior low-sheen, penetrating stain.

F. Fiber cement panels and trim:

1. Surfaces to receive Flat Finish:

- a. General: Acrylic finish, two finish coats over primer.
- b. Primer: Factory primed.
- c. Finish Coats: Exterior low-sheen, VOC/low odor acrylic paint.

G. Wood Benches:

1. All bench surfaces: Top, bottom, edges and ends to receive waterborne transparent finish:

- a. General: Apply cleaner/neutralizer prior to finish sanding.
- b. Penetrating Wood Stabilizer: Two finish coats.

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3.05 INTERIOR PAINT SCHEDULE

A. Gypsum Board Ceilings and Acoustic Panels:

1. Ceilings to receive Flat Finish:
 - a. General: Acrylic finish, two finish coats over a primer.
 - b. Primer: Interior zero VOC/low odor primer as specified for substrate indicated.
 - c. Finish Coats: Interior flat zero VOC/low odor acrylic paint.

B. Gypsum Board Walls and Ceilings

1. Walls and Ceilings to receive Low-Luster (Eggshell) Finish:
 - a. General: Acrylic finish, two finish coats over a primer.
 - b. Primer: Primer: Interior zero VOC/low odor primer as specified for substrate indicated.
 - c. Finish Coats: Interior low-luster (eggshell) zero VOC/low odor acrylic enamel.
2. Walls and Ceilings to receive Semi-Gloss Finish:
 - a. General: Acrylic finish, two finish coats over a primer.
 - b. Primer: Primer: Interior zero VOC/low odor primer as specified for substrate indicated.
 - c. Finish Coats: Interior semi-gloss zero VOC/low odor acrylic enamel.

C. Metal Doors and Frames, and Other Non-Prefinished Miscellaneous Metal, including Exposed Piping, Conduits, Ductwork, and Other Items:

1. Ferrous Metal:
 - a. Acrylic Finish: Two finish coats over a primer.
 - 1) Primer: Interior primer as specified for substrate indicated (not required on shop-primed items).
 - 2) Finish Coats: Interior semi-gloss zero VOC/low odor acrylic enamel.
2. Zinc-Coated Metal:
 - a. Acrylic Finish: Two finish coats over a primer.

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- 1) Primer: Interior primer as specified for substrate indicated (not required on shop-primed items).
 - 2) Finish Coats: Interior semi-gloss zero VOC/low odor acrylic enamel.
- D. Typical Exposed Steel Items not indicated to be Painted with Interior HighPerformance Topcoats including exposed interior structural steel; and items specified in Section 05 50 00 "Metal Fabrications":
1. Acrylic-Enamel Finish: Two finish coats over a primer.
 - a. Primer: Interior primer as specified for substrate indicated.
 - b. Finish Coats: Interior semi-gloss zero VOC/low odor acrylic enamel.
- E. Wood - Flat Finish (Interior Exposed Roof Structure)
1. Flat Finish: Two finish coats over a primer.
 - a. Primer: Interior zero VOC primer as specified for substrate indicated.
 - b. Finish Coats: Interior flat zero VOC/low odor acrylic paint.
- F. Wood - Opaque Enamel Finish:
1. Acrylic-Enamel Finish: Two finish coats over a primer.
 - a. Primer: Interior primer as specified for substrate indicated.
 - b. Finish Coats: Interior semi-gloss zero VOC/low odor acrylic enamel.
- G. Wood - Transparent Finish (plywood wainscot panels; wood slatwall and paneling; miscellaneous trim:
1. Transparent stain and sealer:
 - a. Wood Stain: One coat bio-based stain.
 - b. Wood Sealer: One coat urethane sealer.
- H. Wood - Transparent Finish for relocated wood casework and tops:
1. Transparent finish:
 - a. One-coat waterborne varnish.

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SECTION 10 11 00 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cork tackboards.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 81 13 - Sustainable Design Requirements: Requirements for certified wood and low-emitting materials.
- C. Section 06 10 00 - Rough Carpentry: Blocking and supports.
- D. Section 09 29 00 - Gypsum Board.
- E. Section 10 11 01 - Fabric-Wrapped Tackable Panels
- F. Section 11 52 00 - Audio Visual Equipment: Wall-mounted projection surfaces.

1.03 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard 2012 (R2020).
- B. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board 2012, with Editorial Revision (2019).
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- D. Underwriters Laboratories - GREENGUARD Certification

1.04 SUBMITTALS

- A. CALGreen Submittals: Provide the following:
 - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
 - 2. Product Data for CALGreen 5.504.4.5 – Composite Wood Products: For composite-wood products, showing requirements for formaldehyde as specified in Table 5.504.4.

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- B. GREENGUARD Certification: Submit certification that products meet GREENGUARD Gold Standard for Chemical Emissions for Building Materials, Finishes and Furnishings.
- C. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for certified wood and low-emitting materials.
- D. Product Data: Provide manufacturer's data on tackboard, trim, and accessories.
- E. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.
- F. Samples: Submit color charts for selection of color and texture of tackboard and trim.
- G. Test Reports: Show compliance to specified surface burning characteristics requirements.
- H. Maintenance Data: Include data on regular cleaning, stain removal.

1.05 WARRANTY

- A. Refer to Division 1 for additional warranty requirements.

PART 2 PRODUCTS

2.01 GENERAL PRODUCT REQUIREMENTS

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for requirements for low-emitting materials, Adhesives and Sealants.
- B. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for requirements for low-emitting materials, Composite Wood Products.
- C. Meet GREENGUARD Gold Standard for Chemical Emissions for Building Materials, Finishes and Furnishings

2.02 MANUFACTURERS

- A. Claridge Products and Equipment, Inc: www.claridgeproducts.com/#sle.
- B. Nelson Adams NACO: www.nelsonadamsnaco.com/#sle.
- C. Substitutions: See Section 01 60 00 - XX Product Requirements.

2.03 VISUAL DISPLAY UNITS

- A. Tackboards: Self-healing burlap-backed Composition cork.
 - 1. Cork Thickness: 1/4 inch.

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2. Color: As selected by the Architect from manufacturer's full range of a minimum of 15 standard colors.
 3. Backing: Hardboard, 1/4 inch thick, laminated to tack surface.
 4. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
 5. Height: 48 inches.
 6. Length: As indicated on drawings.
 7. Frame: Same type and finish as for markerboard.
 8. Frame: Extruded aluminum , with concealed fasteners.
 9. Frame Finish: Anodized, natural.
 10. Manufacturers:
 - a. Nelson Adams NACO: www.nelsonadamsnaco.com/#sle.
 - b. Claridge Corporation: www.claridgeproducts.com/#sle..
- B. Units Made of More Than One Panel: Factory-assembled tackboards in a single frame, of materials specified above.
1. Join panels of similar construction with butt joints, aligned and secured with steel spline concealed in edge of core.
 2. Configuration: As indicated on drawings.
 3. Units Too Large to Ship Assembled: Fully assembled in factory, then disassembled for shipping.

2.04 MATERIALS

- A. Hardboard for backing: ANSI A135.4 Tempered type. Comply with CALGreen requirements for low-emitting materials.
- B. Burlap: Tightly woven, flame retardant treated.
- C. Self-healing burlap-backed composition cork: Linseed oil, granulated cork, resin binders, and dry pigments mixed and calendered onto a natural burlap backing.
- D. Fiber Board: ASTM C208, cellulosic fiber board. Comply with CALGreen requirements for low-emitting materials.

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- E. Adhesives: Type used by manufacturer. Comply with CALGreen requirements for low-emitting materials.

2.05 ACCESSORIES

- A. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.
- B. Mounting Brackets: Concealed.

2.06 FABRICATION

- A. Fabricate units in accordance with approved submittals.
- B. Make joints only where total length exceeds maximum manufactured length. Fabricate with the minimum number of joints, balanced around the center of the surface, as acceptable to the Architect.
- C. Where the size of boards or other conditions exist that require support in addition to the normal trim, provide structural supports or modify the trim as indicated or as selected by the Architect from the manufacturer's standard structural support accessories to suit the condition indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install boards in accordance with manufacturer's instructions.
- B. Secure units level and plumb.
- C. Butt Joints: Install with tight hairline joints.

3.03 CLEANING

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Cover with protective cover, taped to frame.
- C. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

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SECTION 10 11 01 - FABRIC-WRAPPED TACKABLE PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acoustic stretched-fabric tackable panels.
- B. Accessories as required for complete installation.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 10 11 00 - Visual Display Units: Prefabricated, framed tackboards.

1.03 REFERENCE STANDARDS

- A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2017.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests 2016.
- D. ASTM E2573 - Standard Practice for Specimen Preparation and Mounting of Site-Fabricated Stretch Systems to Assess Surface Burning Characteristics 2019.

1.04 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. CALGreen Submittals: Provide the following:
 - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
 - 2. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- C. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.

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2. Storage and handling requirements and recommendations.
 3. Installation methods.
 4. Specimen warranty.
- D. Shop Drawings: Details indicating typical transitions to other finish surfaces.
- E. Selection Samples: Fabric swatches representing manufacturer's full range of available colors, textures, and patterns.
- F. Verification Samples:
1. For each fabric specified, minimum size 12 inch square, representing actual product in color, texture, and pattern.
 2. Actual samples of each frame profile to be used, including transitions between dissimilar profiles.
 3. Acoustic material, minimum size 12 inch square.
- G. Test Reports: Certified test data from an independent test agency verifying that wall systems meet specified requirements for acoustical and fire performance.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.
- J. Warranty Documentation: Submit manufacturer's warranty and ensure that forms have been completed in District's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect fabric, acoustical backing, and track from excessive moisture in shipment, storage, and handling.
- B. Do not deliver materials to project until wet work such as concrete and plaster has been completed.
- C. Store products in manufacturer's unopened packaging until ready for installation.

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- D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Do not begin installation until interior conditions have reached temperature and humidity that will be maintained during occupancy.
- B. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

- A. Correct defective work within five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials, Adhesives and Sealants.

2.02 MANUFACTURERS

- A. Acoustic Stretched-Fabric Tackable Panels:
1. FabriTRAK Systems, Inc: www.fabritrak.com/#sle.
 2. Fabric Wall: www.fabric-wall.com/#sle.
 3. Fabricmate Systems: www.fabricmate.com/#sle.
 4. Novawall Systems, Inc: www.novawall.com/#sle.

2.03 ACOUSTIC STRETCHED-FABRIC TACKABLE PANELS

- A. Acoustic Stretched-Fabric Tackable Panels: Field installed, fabric is stretched and set into framework and laid over tackable acoustic material anchored to substrate. Framework consists of continuous perimeter and intermediate mounting frames anchored to substrate, and designed to permit removal and replacement of fabric within framed areas without affecting adjacent areas.
1. Surface Burning Characteristics: Flame Spread Index of 25, maximum; Smoke Developed Index of 450, maximum; when whole system is tested in accordance with ASTM E84 using mounting specified in ASTM E2573 for stretched systems.

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2. Noise Reduction Coefficient (NRC): 0.55, minimum, when tested in accordance with ASTM C423, Type A mounting per ASTM E795.
3. Prefabricated, fabric covered and individually framed panels are not permitted.
4. Install fabric over acoustic material and into framework without use of adhesives, tapes, or fasteners.
5. Seams in fabric are not permitted; base the frame layout dimensions on fabric at least 72 inch wide.

2.04 MATERIALS

- A. Frame: Extruded polymer framing system with serrated jaws of sufficient strength to hold fabric in place after repeated applications.
 1. Wall Frame Size: 1/2 inch height from wall substrate with minimum 1 inch wide base.
 - a. Wall Frame Shape: Square at perimeter, and square at intermediate abutting joints.
 - b. Application: Apply acoustic material to wall locations as indicated on drawings.
 2. Frame Color: As selected from manufacturer's standard colors.
- B. Tackable and Acoustic Material:
 1. Ensure that thickness of tackable acoustic material fills depth of frame as necessary for application without use of support blocking.
 2. Polyester Board: Minimum of 60 percent recycled materials and formaldehyde free, Class A fire rated in accordance with ASTM E84.
 - a. Overall Thickness: 1/2 inch.
 - b. Density: 7 to 10 lbs/cu ft.
 - c. Panel Size: Manufacturer's standard, cut to fit.
- C. Fabric: Heavy-duty fire-retardant commercial fabric, as provided by manufacturer of acoustic stretched-fabric system; color, pattern, and texture as selected from fabric manufacturer's full range of Price Group 1 or 2 fabrics for tackable panels.
 1. Manufacturers:
 - a. Basis of Design: Carnegie Xorel.

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- b. Maharam
- 2. Fabric: Biobased high performance interior textile; plant-based product bio content between 60-85%.
- 3. Pattern: Xorel "Dash".
- 4. Color: As selected from manufacturer's full standard range for selected pattern.
- D. Fasteners: As recommended by manufacturer of acoustic stretched-fabric system in accordance with project requirements.
- E. Adhesives: Low VOC or water-based, and approved by acoustic stretched-fabric system manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Begin installation only after substrates have been properly prepared.
- B. Verify that casework, visual display units, wainscot panels, door and window jambs, finished ceiling, and other finished items adjacent or abutting the acoustic stretched-fabric system have been properly installed.
- C. When preparation of substrate is the responsibility of another installer, notify Architect of unsatisfactory preparation prior to proceeding with this work.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation of this work.
- B. Prepare substrate surfaces using methods as recommended by the manufacturer for achieving acceptable result as required for this work.

3.03 INSTALLATION

- A. Install acoustic stretched-fabric system at locations indicated in accordance with approved shop drawings and manufacturer's instructions.
- B. Frames: Install perimeter and intermediate frames using appropriate fasteners for prepared substrate, firmly secured to ensure frames do not separate from substrate.
 - 1. Follow contours of wall and scribe to adjoining work at borders, penetrations, and imperfections.
 - 2. Install framing around openings and penetrations.

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3. Allow for spacing of framework to accommodate insertion of installation tool.
- C. Acoustic Material: Cut and trim acoustic material to fit snugly within perimeter and intermediate framework.
1. Apply adhesive and press acoustic material into place, maintaining constant plane.
 2. At fixtures mounted within areas of acoustic stretched-fabric system, install rigid blocking for backing and maintain plane of fixture surface flush with face of acoustic stretched-fabric system.
- D. Fabric: Stretch fabric over acoustic material, locking edges of fabric into frame's serrated jaws using manufacturer's recommended tool. Maintain fabric weave plumb, level and true, in proper relation to building lines, without ripples, waviness, hourglass, or other deleterious effects.
1. Upon fabric installation, do not employ adhesives or mechanical fasteners of any type, and ensure fabric is free-floating and in contact with acoustic material as necessary.
 2. Stapling or gluing of fabric to cores or channel framework is not permitted.
 3. Provide tension in fabric sufficient to prevent sagging under anticipated changes in temperature and humidity.

3.04 CLEANING

- A. Clean exposed surfaces of acoustic stretched-fabric system in compliance with manufacturers instructions for cleaning and repair of minor damage to exposed surfaces.
- B. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage to system.

3.05 PROTECTION

- A. Protect installed materials upon completion of this work, using methods that will ensure that the finished work is without damage or deterioration upon Date of Substantial Completion.

END OF SECTION

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SECTION 10 14 00 - SIGNAGE

PART 1 GENERAL

1.01 SUMMARY

- A. The work included under this section consists of furnishing all products, materials, finishes, supplies, equipment, tools and transportation, and performing all labor and services necessary for, required in connection with, or properly incidental to furnishing and installing signage as described in this section of the specifications, shown on the accompanying drawings, or reasonably implied therefrom, except as hereinafter specifically excluded.
- B. Work Summary:
 - 1. Create final production artwork and layouts for each sign face.
 - 2. Furnish materials and labor associated with fabricating and finishing all signs.
 - 3. Provide packaging and transportation of all signs to the project site.
 - 4. Furnish material and labor required for installation of signage.
 - 5. All code required signage shall be field inspected per CBC 11B-703.1.1.2

1.02 SUBMITTALS

- A. Color Samples: Submit three sets of 6"x6" samples of each color for approval. See design drawings for colors and materials.
- B. Product Data Sheets. Supply product data sheets for all products used in the manufacture and installation of signage.
- C. Contractor shall be responsible for the structural design of freestanding signs, internal illumination, and methods for fastening and installation.
- D. Applicable Standards and Publications: Unless otherwise specified or shown, signage shall conform to the following standards and publications:
 - 1. ANSI A-117.1 and the Americans with Disabilities Act (ADA).
 - 2. ATBCB Design Guidelines for Signage in relation to the Americans with Disabilities Act.
 - 3. California Building Code (CBC), 2019, Sections 11B-216 and 11B-701-703.
 - 4. California Grade 2 Braille shall be used whenever Braille symbols are specifically required. Refer to CBC Section 11B-703.
- E. ANSI A-117.1 and the Americans with Disabilities Act (ADA).
- F. ATBCB Design Guidelines for Signage in relation to the Americans with Disabilities Act.
- G. California Building Code (CBC), 2019, Sections 11B-216 and 11B-701-703.
- H. California Grade 2 Braille shall be used whenever Braille symbols are specifically required. Refer to CBC Section 11B-703.
- I. Contractor shall be responsible for the quality of materials and workmanship of any firm acting as the Contractor's subcontractor.
- J. Welding, where required, shall be in accordance with procedures specified in American Welding Society Standards using procedures, materials, and equipment of the type required for the work.

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1.03 GUARANTEE

- A. At a minimum, the Contractor shall warrant that all work installed under this Contract is free of defect and will remain in good working order for a period of one year for all surface improvements and five years for all underground work. If warranties specified elsewhere in these documents are for a longer period of time than that specified in this section, the longer warranties shall apply.
- B. Manufacturer's Standard Product Warranties:
 - 1. Plastic Elements: Manufacturer's warranty against yellowing, cracking, crazing, or other visible and performance defects for a period of 5 years from the date of installation.
 - 2. Paint Coating: Acrylic polyurethane coating manufacturer's 5-year warranty against defects in materials.

PART 2 CODE REQUIRED SIGNAGE

2.01 TYPES OF SIGNS

- A. Room Identification: Interior and exterior signs identifying permanent rooms and spaces shall comply with CBC Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5. Where pictograms are provided as designations of permanent rooms and spaces, the pictograms shall comply with CBC Section 11B-703.6 and shall have text descriptors complying with CBC Sections 11B-703.2 and 11B-703.5.
- B. Egress Signage: Signs for means of egress shall comply with CBC Section 11B-216.4.
- C. Directional & Informational: Signs that provide direction to or information about interior and exterior spaces and facilities of the site shall comply with CBC Section 11B-703.5.
- D. Toilet Room Signage: Signage for toilet rooms shall comply with CBC 11B-216.8.
- E. Assistive Listening Systems: Signage for assistive listening systems shall comply with CBC 11B-216.10

2.02 RAISED CHARACTERS: Raised characters shall comply with CBC Section 11B-703.2 and shall be duplicated in Braille complying with CBC Section 11B-703.3. Raised characters shall be installed in accordance with CBC Section 11B-703.4.

2.03 BRAILLE. Braille shall be contracted (Grade 2) and shall comply with CBC Sections 11B-703.3 and 11B-703.4.

2.04 INSTALLATION HEIGHT AND LOCATION. Signs with tactile characters shall comply with CBC Section 11B-703.4.

2.05 VISUAL CHARACTERS. Visual characters shall comply with CBC Section 11B-703.5.

2.06 PICTOGRAMS. Pictograms shall comply with CBC Section 11B-703.6.

2.07 SYMBOLS OF ACCESSIBILITY. Symbols of accessibility shall comply with CBC Section 11B-703.7.

2.08 BACKGROUNDS: All sign backgrounds to have a non-glare finish.

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PART 3 PRODUCTS

3.01 MATERIALS

- A. Acrylic Sheet. Cast methyl methacrylate monomer plastic conforming to ASTM D788, Sign Grade; "Plexiglas SQ" by Altuglas or equal, unless otherwise recommended by fabricator. Sizes and thicknesses as shown.
- B. Silicone adhesive to be Dow Corning or approved equal, clear unless otherwise specified.
- C. Adhesive tapes to be 3M or approved equal.
- D. Paint products to be low VOC Matthews Acrylic Polyurethane or approved equal in colors specified. All finishes to be non-glare. Provide primer as recommended by coating manufacturer for each type of substrate.
- E. Screen-printing enamel to be Nazdar or approved equal.
- F. Engraving substrate to be Rowmark or approved equal. www.rowmark.com
- G. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.
- H. Vinyl opaque film with pressure-sensitive adhesive backing, suitable for exterior applications, to be 3M or approved equal.
- I. Sealant: As required to prevent light and water leakage. No exposed sealant shall be allowed except as indicated on the reviewed shop drawings.
- J. LED lighting components to be Bitro Group or approved equal. Light color temp to be warm white, 2,700°K to 3,000°K
- K. Metal wire mesh to be stainless steel Type 304, welded 3" x 3" mesh with 2.8120" square openings, 0.188" dia. Wire and 87% open space. McNichols item 3823190041 or approved equal.

PART 4 EXECUTION

4.01 GENERAL

- A. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary flanges, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible.
- B. Shop fabricate so far as practicable. Joints shall be fastened flush to conceal reinforcement, or welded where thickness or section permits.
- C. Contact surfaces of connected members must be assembled so joints will be tight and practically unnoticeable, with minimal use of filling compound.
- D. Signs shall have fine, even texture and be flat and sound. Lines and miters sharp, arises
- E. unbroken, profiles accurate and ornament true to pattern. Plane surfaces to be smooth flat and without oil-canning, free of rack and twist. Restore texture to filed or cut areas.
- F. Level or straighten wrought work. Members shall have sharp lines and angles and smooth surfaces.
- G. Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.
- H. Form joints exposed to weather to exclude water.
- I. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Edge joints shall be tightly mitered to give appearance of solid material.

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- J. All painted surfaces shall be properly primed. Finish coating of paint to have complete coverage with no light or thin applications allowing substrate or primer to show. Finished surface shall be smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.
- K. Movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of members. Doors and covers shall be centered in openings or frames. All contact surfaces fit tight and even without forcing or warping components.
- L. All fasteners to be non-corrosive.
- M. Security head screw to be used for all fasteners. Contractor to coordinate type of security screws used with campus facilities department.

4.02 CUTTING & FINISHING

- A. All materials shall be cut with proper equipment using sharp blades. Shapes shall have square corners, straight edges and shall be sized as shown in the design drawings. Blade/cutter marks and scratches will not be accepted.
- B. Materials shall be prepared and primed according to product manufacture's instructions before painting.
- C. Finishes shall be applied according to product manufacturer's instructions, then properly cured and protected after application.

4.03 APPLICATION OF GRAPHICS

- A. All graphics shall be cut, etched and/or printed to comply with the specified typeface and graphic shapes. Graphics and type shall be clean and crisp without deformation of characters, ticks, gaps or irregularities.
- B. Finished surfaces shall be protected from damage during application of graphics.

4.04 PACKAGING

- A. Completed signs shall be packed for shipment to the project site to protect from damage.
- B. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

PART 5 INSTALLATION

5.01 GENERAL

- A. Protect products against damage during field handling and installation. Protect adjacent existing and newly placed construction, landscaping and surrounding wall and/or building finishes as necessary to prevent damage during installation. Paint and touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface.
- B. All exterior signs to be staked by contractor for owner's approval prior to sign installation or excavation.
- C. Contractor will be responsible for verifying that, at each sign location, there are no utility lines that will be affected by installation of signs. Any damage during installation of signs to utilities will be the sole responsibility of the Contractor to correct and repair.

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- D. Furnish inserts and anchoring devices which must be set in concrete or other material for installation of signs. Provide setting drawings, templates, instructions and directions for installation of anchorage devices, which may involve other trades.
- E. Mount signs in proper alignment, level and plumb. When exact position, angle, height or location is in doubt, contact Designer for clarification.
- F. Remove or correct signs or installation work Owner determines as unsafe or as an unsafe condition.

5.02 CLEANING & ADJUSTING

- A. Return items that cannot be refinished in the field to the shop. Make required alterations and refinish entire unit, or provide new units.
- B. Verify gaskets and flanges interface properly to provide a lightproof installation at monument sign.
- C. After installation, clean soiled signs surfaces according to manufacturer's instructions. Protect from damage until acceptance by University.
- D. At completion of sign installation, clean exposed sign surfaces. Clean and repair any adjoining surfaces and landscaping that became soiled or damaged as a result of installation of signs.

5.03 PUNCHLIST & PROJECT CLOSEOUT

- A. Sign contractor shall review all installed work with the Client or Client's representative and make all required punchlist corrections. Once complete, the sign contractor shall back-check all punchlist items and receive Client's final approval of installation.

5.04 RECORD DOCUMENTS

- A. As-Built Drawings
- B. The Contractor shall submit to the University's Representative, 10 calendar days after Final Completion, fully updated As-built Drawings and Shop Drawings for review.
- C. The As-Built Drawings and Shop Drawings shall be in PDF format. Email is acceptable.

END OF SECTION

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SECTION 10 21 13.17 - PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Compact Laminate Phenolic toilet compartments.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 06 10 00 - Rough Carpentry: Blocking and supports.
- C. Section 10 28 00 - Commercial Toilet Accessories.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.04 SUBMITTALS

- A. Product Data: Provide data on panel construction, hardware, and accessories.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- C. Samples: Submit two samples of partition panels, 4 inch in size illustrating panel finish, color, and sheen.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Phenolic Toilet Compartments:
 - 1. Bobrick; Duraline Series CGL, model 3080 G is Basis of Design.
 - 2. Acceptable manufacturers, subject to compliance with performance and dimensional features:
 - a. ASI: Ultimate Privacy Zero Sightline series.

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2.02 PHENOLIC TOILET COMPARTMENTS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted headrail-braced. Provide system with interlocking sightline-free design at doors and pilasters.

1. Color: Single color as selected.

B. Doors:

1. Thickness: 3/4 inch.

2. Width: 36 inch unless otherwise indicated.

3. Width for Handicapped Use: 36 inch, out-swinging.

4. Height: 84 inch.

C. Panels:

1. Thickness: 1/2 inch.

2. Height: Nominal full height. 84 inch.

D. Pilasters:

1. Thickness: 3/4 inch.

2. Width: As required to fit space; and as indicated on drawings.

2.03 ACCESSORIES

A. Pilaster and Panel Supports: ASTM A666 Type 304 recessed stainless steel pedestal providing nominal 1 inch clearance to floor.

B. Head Rails: Hollow anodized aluminum, 1 inch by 1-1/2 inch size, with cast socket wall brackets.

C. Wall and Pilaster Brackets: Natural anodized aluminum; continuous type.

D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.

E. Hardware: Type 304, Polished stainless steel:

1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.

2. Nylon bearings.

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3. Door Latch: Occupancy indicator latch with exterior emergency access feature.
 - a. Latch for accessible stalls shall flip-over or sliding operation which does not require the user to grasp or twist.
4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
5. Coat hook with rubber bumper; one per compartment, mounted on door.
6. Provide door pull for outswinging doors.
 - a. Provide door pull at both sides of doors at accessible stalls. Locate pulls near the latch.
7. Compliance: operating force of less than 5lb (2.25kg).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

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3.04 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

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SECTION 10 26 00 - WALL PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Corner guards fabricated from rolled metal sections or bent plate.
- B. Section 06 20 00 - Finish Carpentry: Plywood wainscot.
- C. Section 07 62 00 - Sheet Metal Flashing and Trim: Exterior corner guards fabricated from galvanized sheet metal, exterior galvanized sheet metal wall covering.
- D. Section 09 29 00 - NT Gypsum Board: Placement of supports in stud wall construction.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Product Data: Indicate physical dimensions, features, anchorage details, and rough-in measurements.
- C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit two sections of each corner and end guard profile, 6 inches long.
- D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

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PART 2 PRODUCTS

2.01 PRODUCT TYPES

A. Corner Guards and Wall End Guards - Surface Mounted:

1. Material: Type 304 304 stainless steel, No. 4 No. 4 finish, 16 gauge, (0.0625 inch) thick.
2. Width of Wings: 2 inches.
3. Corner: Square.
4. Length: One piece.
5. Pre-Punch for fasteners 1 inch from each end and no more than 16 inches on center equally spaced over length of guard.
 - a. At end guards, prepunched holes shall be aligned symmetrically on both wings. No fasteners on end face of wall end guard.

2.02 FABRICATION

- A. Fabricate with straight, true profiles free of distortions, burrs, and surface imperfections.
- B. Provide protective strippable film to protect units until project completion.
- C. Pre-drill holes for attachment.
- D. Finish edges and ends bevelled and smooth.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that concealed blocking is correctly sized and located.
- B. Verify that field measurements are as indicated on drawings.
- C. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position corner and end guards to heights indicated on drawings.

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3.03 TOLERANCES

- A. Maximum Variation From Required Height: 1/4 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

- A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.
- B. Remove strippable protective film at completion of project.

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SECTION 10 28 13 - COMMERCIAL TOILET ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Accessories of the following types are owner furnished contractor-installed (OFCI):
 - 1. Paper towel dispensers.
 - 2. Toilet seat cover dispensers.
 - 3. Toilet paper dispensers.
 - 4. Soap dispensers.
- B. Accessories of the following types are contractor furnished contractor Installed (CFCI):
 - 1. Grab bars at accessible toilet stalls.
 - 2. Sanitary napkin disposals.
 - 3. Framed mirror units.
 - 4. Sanitary napkin vendors.
 - 5. Lavatory plumbing insulation.
 - 6. Mop and broom holders at Janitor closets.
 - 7. Diaper changing stations.
 - 8. Wall mounted coat hooks.
 - 9. Wall mounted waster receptacles.

1.02 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 81 13 - Sustainable Design Requirements.
- C. Section 08 80 00 - Glazing : Custom, unframed mirror units; mirror fabrication requirements.

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1.03 SUBMITTALS

- A. Product Data: Provide for each toilet accessory item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, specified options, and finishes.
- B. Shop Drawings: Identify where cutouts are required in other work, including templates, substrate preparation instructions, and directions for preparing cutouts and installing anchorage devices.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Instructions, including replaceable parts and service recommendations.

1.05 QUALITY ASSURANCE

- A. Inserts and Anchorages: Furnish accessory manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other work to avoid delay.

1.06 PROJECT CONDITIONS

- A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Basis-of-Design Product: The design for the toilet accessories is based on the manufacturer identified below. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
 - 1. Basis-of-Design: Bobrick Washroom Equipment.
 - 2. American Specialties.
 - 3. Bradley Corporation.
 - 4. Accepted equivalent.
- B. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 0.034-inch (22-gage) minimum thickness.
- C. Mirror Glass: Nominal 6.0-mm (0.23-inch) thick, conforming to ASTM C1036, Type I, Class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic

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coating.

- D. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).
- E. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.
- F. Galvanized Steel Mounting Devices: ASTM A153, hot-dip galvanized after fabrication.
- G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

2.02 FABRICATION

- A. General: Only a maximum 1-1/2-inch-diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.
- C. Recessed and Semi-Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.
- D. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation.
 - 1. Provide galvanized-steel backing sheet, not less than 0.034 inch (22 gage) and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.
- E. Mirror Unit Hangers: Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove that will permit rigid, tamperproof, and theftproof installation.
- F. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to Owner's representative.

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PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.
- B. Apply sealant to perimeter between accessories and wall surface where accessory edge is permanent.
- C. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.
- D. Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F446.

3.03 ADJUSTING

- A. Adjust accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

3.04 CLEANING

- A. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.
- B. Construction Waste Management: Manage construction waste in accordance with provisions of Section 01 74 19 - Construction Waste Management and Disposal

3.05 SCHEDULE

- A. Model numbers used in this schedule are Bobrick unless noted otherwise; other manufacturers of equal quality and function may be accepted subject to Architect's approval.
- B. Grab Bars (GB) CFCI: Toilet compartment horizontal two-wall bars, 1-1/2-inch diameter, one Bobrick Model B-6806 x 36 and one B-6806 x 42, heavy-duty size, concealed mounting using manufacturer's standard flanges and anchorages; smooth, satin finish gripping

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surfaces.

- C. Surface-Mounted Sanitary Napkin Vendors (SNV) CFCI: Bobrick Model B-370634, 25 cent coin operation.
- D. Toilet Seat Cover Dispenser: Surface seat cover dispenser (TSCD) OFCI: Bobrick Model B-221.
- E. Surface-Mounted Sanitary Napkin Disposal Units (SND) CFCI: Bobrick Model B-270.
- F. Toilet Paper Dispensers (TPD1) OFCI: Bobrick Model B-4288; surface-mounted toilet paper holder for two rolls.
- G. Toilet Paper Dispenser (TPD3) OFCI: Kimberly Clark Model KCI 09608 surface mounted toilet paper dispenser for jumbo roll; smoke gray color.
- H. Soap Dispenser: (SD) Gojo FMX-20, OFCI
- I. Stainless Steel Framed Mirror Units (MIR) CFCI: Bobrick Model B-290; 24 inches x 36 inches.
- J. Mop and Broom Holder/Utility Shelf (MR) CFCI: Bobrick Model B-239.
- K. Under-Lavatory Guard: Under-Lavatory Guard CFCI: Plumberex; antimicrobial, molded closed cell PVC covering with PVC Velcro closure for supply and drain piping assemblies, with weep hole at bottom of J-bend to provide for condensation drainage and air circulation; intended for use at accessible lavatories to prevent direct contact with and burns from piping.
 - 1. Interior: Color white.
 - 2. Exterior and Greenhouses: Color gray.
- L. Diaper Changing Station - Recessed (DCS) CFCI: Koala Model KB-110-SSRE; stainless steel exterior with smooth concave changing area, nylon safety strap, two hooks for bags, and instruction graphics
- M. Diaper Changing Station - Surface mounted (DCS) CFCI: Koala Model KB-110-SSWM; stainless steel exterior with smooth concave changing area, nylon safety strap, two hooks for bags, and instruction graphics
- N. Paper Towel Dispensers (PTD) OFCI: Kimberly Clark Model KCI 09990 surface mounted roll-towel dispenser, black color.
- O. Paper Towel Dispensers (PTDF) OFCI: Kimberly Clark Model 43823 surface mounted C-fold towel dispenser, stainless steel.

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P. Waste Receptacles (WR) OFCI: Wall mounted waste receptacle; satin stainless steel, Bobrick Model B-275; 20 gallon capacity.

Q. Wall Mounted Coat Hook (CH) CFCl: Model B-6827, satin stainless hat and coat hook.

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SECTION 10 43 00 - EMERGENCY AID SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Automated external defibrillators (AEDs).
- B. Automated external defibrillator (AED) cabinets.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.03 DEFINITIONS

- A. Automated External Defibrillator (AED): A Food and Drug Administration (FDA)-approved portable device, which automatically analyzes the heart rhythm and recognizes the presence of ventricular fibrillation and/or tachycardia. If defibrillation is warranted, the AED automatically charges and prompts (visual and/or audio) the operator to deliver an electrical shock.

1.04 SUBMITTALS

- A. Product Data: Provide AED operational features, color and finish, anchorage details, and installation instructions.
- B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
- C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Maintenance Data: Include test schedules and recertification requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Automated External Defibrillators (AEDs):
 - 1. Philips Medical Systems: www.usa.philips.com/#sle.

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2. Stryker Corporation; HeartSine samaritan PAD 350P Defibrillator - PAD 350p:
www.stryker.com/#sle.

3. ZOLL Medical Corporation: www.zoll.com/#sle.

B. Emergency Aid Cabinets and Accessories:

1. Activar Construction Products Group, Inc. - JL Industries; LifeStart 1400 Series AED Cabinet: www.activarcpg.com/#sle.

2. Modern Metal Products, a division of Technico, Inc: www.modern-metal.com/#sle.

2.02 AUTOMATED EXTERNAL DEFIBRILLATORS (AEDs)

A. Automated External Defibrillators (AEDs) - General: FDA approval required.

1. Provide automated external defibrillators (AEDs) as indicated.

2.03 EMERGENCY AID CABINETS

A. Type: Automated external defibrillator (AED).

B. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

C. Cabinet Construction: Non-fire-rated.

1. Formed primed steel sheet; 0.036 inch thick base metal.

D. Fire-Rated Cabinet Construction: One-hour fire rated.

1. Steel; double wall or outer and inner boxes with 5/8 inch thick fire barrier material.

E. Cabinet Configuration: Recessed type.

1. Size to accommodate AED.

2. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim.

F. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with wire pull handle and nylon catch. Hinge door for 180 degree opening with two butt hinges.

G. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.

H. Cabinet Mounting Hardware: Appropriate to cabinet, with predrilled holes for placement of anchors.

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- I. Fabrication: Weld, fill, and grind components smooth.
- J. Finish of Cabinet Exterior Trim and Door: Primed for field paint finish.
- K. Finish of Door Pull or Handle: Stainless steel.
- L. Finish of Cabinet Interior: White powder coat.

2.04 ACCESSORIES

- A. Cabinet Door Signage: 'AED" decal, or vinyl self-adhering, prespaced black lettering and identifying graphic in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets level and plumb at height indicated on drawings for accessibility.
- C. Secure rigidly in place.
- D. Place AEDs in cabinets.
- E. Cabinet Lettering:
 - 1. Location: Face of door framing.
 - 2. Apply lettering on factory-finished cabinets either at the factory or just prior to Substantial Completion.

3.03 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust cabinet doors to operate smoothly without binding. Verify that alarms and integral locking devices operate properly.
- C. On completion of cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

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- D. Touch up marred finishes. Replace cabinets that cannot be restored to factory-finished appearance. Use materials and procedures recommended by cabinet manufacturer.

3.04 CLOSEOUT ACTIVITIES

- A. Demonstrate proper operation of AED to District's designated representative.

END OF SECTION

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SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets for interior and exterior applications.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Division 21 - Fire suppression systems:

1.03 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide current edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers 2017, with Errata (2018).
- C. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

- A. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, and anchorage details.
- B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
- C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers:

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1. Larsen's Manufacturing Company, a unit of Morris Group International:
<https://www.larsensmfg.com>.
2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
3. Potter-Roemer: www.potterroemer.com/#sle.

B. Fire Extinguisher Cabinets and Accessories:

1. Larsen's Manufacturing Co: www.larsensmfg.com/#sle: "Architectural" Series, full glass door style.
2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
3. Potter-Roemer: www.potterroemer.com/#sle.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General:** Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers:** Carbon steel tank, with pressure gauge.
1. Class: 3-A:40-B:C type.
 2. Size: 5 pound minimum.
 3. Finish: Baked polyester powder coat, red color.
 4. Temperature range: Minus 40 degrees F to 120 degrees F.
- C. Dry Chemical Type Fire Extinguishers:** (Kitchen) Stainless steel tank, with pressure gauge.
1. Class: K type.
 2. Size: 1.6 gallons.
 3. Finish: Polished stainless steel.
 4. Temperature range: Minus 20 degrees F to 120 degrees F.

2.03 INTERIOR FIRE EXTINGUISHER CABINETS

- A. Cabinet Construction:** Non-fire rated.

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1. Formed primed steel sheet; 0.036 inch thick base metal.
- B. Cabinet Configuration: Semi-recessed type.
1. Size to accommodate accessories.
 2. Trim: Flat square edge, with nominal 2 inch wide face.
 3. Projected Trim: Returned to wall surface, with nominal 2 inch projection, and nominal 2 inch wide face.
 4. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim.
- C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.
- D. Door Glazing: Float glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.
- E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- F. Fabrication: Weld, fill, and grind components smooth.
- G. Finish of Cabinet Exterior Trim and Door: Primed for field paint finish.
- H. Finish of Cabinet Interior: White colored enamel.

2.04 EXTERIOR FIRE EXTINGUISHER CABINETS

- A. Cabinet Construction: Non-fire rated; equivalent to Larsen's AL-2409-SM or equal.
1. Fabricated aluminum; 1/2 inch thick base metal.
- B. Cabinet Configuration: Surface mounted type.
1. Dimensions
 2. Tub: 13 inches wide by 27-1/2 inches high by 6 inches deep.
 3. Overall Outside Trim: 13 inches wide by 27-1/2 inches high.
 4. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim.
- C. Door Style: Aluminum with clear acrylic glazing; equivalent to Larsen's, "Horizontal Duo".
- D. Hinge: Full length stainless steel piano hinge.

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- E. Safety Break Lock: Manufacturer's standard with factory-applied safety break label.
- F. Cabinet Mounting Hardware: Appropriate to exterior installation cabinet, with pre-drilled holes for placement of anchors.
- G. Finish: Manufacturer's standard clear anodized.

2.05 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.
- B. Lettering: "FIRE EXTINGUISHER" decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings. Refer to drawings for mounting height to comply to accessibility requirements.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.

END OF SECTION

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SECTION 10 51 29 - PHENOLIC LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Phenolic lockers.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.04 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan.
- D. Samples: Submit two samples 6 by 6 inches in size, of each color scheduled.
- E. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Phenolic Lockers:
 1. Columbia Lockers, a division of PSiSC; Phenolic Lockers: www.psis.com/#sle.
 2. List Industries, Inc: www.listindustries.com/#sle.

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2.02 LOCKER APPLICATIONS

- A. Box Lockers: Phenolic lockers, wall mounted with matching closed base.
1. Accessibility: Comply with ICC A117.1 and ADA Standards.
 2. Width: 15 inches.
 3. Depth: 18 inches.
 4. Height: 15 inches.
 5. Locker Configuration: Five tier.
 6. Ventilation: By open space between the back of the door and locker body.
 7. Locking: Built-in combination locks.
 8. Locking for designated accessible lockers: Built-in battery-operated digital lock. Master Lock 3685 Electronic Built-In Locker Lock.

2.03 PHENOLIC LOCKERS

- A. Lockers: Factory assembled, made of phenolic core panels with mortise and tenon joints and stainless steel mechanical joint fasteners; fully finished inside and out; each locker capable of standing alone.
1. Doors: Full overlay, covering full width and height of locker body; slightly curved edges.
 2. Panel Core Exposed at Edges: Machine polished, without chips or tool marks; square edge unless otherwise indicated.
 3. Where locker ends or sides are exposed, finish the same as fronts or provide extra panels to match fronts.
 4. Provide filler strips where indicated, securely attached to lockers.
 5. Door Color: As selected by Architect.
 6. Body Color: Manufacturer's standard white or light color.
 7. Fasteners for Accessories and Locking Mechanisms: Tamperproof type.
- B. Component Thicknesses:
1. Doors: 1/2 inch minimum thickness.

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2. Locker Body: One of the following combinations:
 - a. Tops, bottoms, and shelves 1/2 inch; sides 3/8 inch; backs 1/4 inch; minimum.
 3. End Panels and Filler Panels: 1/2 inch minimum thickness.
 4. Toe Kick Plates: 1/2 inch minimum thickness. 4 inch height to align with adjacent casework.
- C. Phenolic Core Panels: Nonporous phenolic resin and paper core formed under high pressure, with natural colored finished edges, integral melamine surface, matte finish, and uniform surface appearance; glued laminated panels not acceptable.
1. Surface Burning Characteristics: Flame spread index of 75 or less, and smoke developed index of 450 or less; when tested in accordance with ASTM E84.
- D. Hinges: Stainless steel, black powder coat finish; minimum of 180 degree opening; either exposed barrel 5-knuckle hinge attached to back of door and inside of body with tamperproof screws, or concealed cabinet style hinge attached with tamperproof screws.
- E. Number Plates: Manufacturer's standard, minimum 4-digit, permanently attached with adhesive; may be field installed.
- F. Built-In Lock Boxes: Same material as locker, manufacturer's standard size, with lock types as noted above.
- G. Locker Legs: Manufacturer's standard adjustable support and leveling leg, minimum 1 inch adjustment; with hardware for attaching toe kick plates. Provide height to accommodate 4 inch high toe kick.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install lockers plumb and square.
- C. Bolt adjoining locker units together to provide rigid installation.
- D. Install accessories.
- E. Replace components that do not operate smoothly.

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3.02 CLEANING

- A. Clean locker interiors and exterior surfaces.

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SECTION 10 56 13 - METAL STORAGE SHELVING AND RACKS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Storage shelving.
- B. Storage cabinets.
- C. Cantilevered racks.
- D. Vertical storage racks.
- E. Safety storage cabinets.
- F. Accessories.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.03 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

1.04 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Rated uniform shelf loads.
 - 2. Details of shelving and rack assemblies, including reinforcement.
 - 3. Accessories.
 - 4. Installation methods.
- B. Test Reports: Provide independent agency test reports documenting compliance with specified structural requirements.
- C. Shop Drawings: Indicate location, type, and layout of shelving, racks, and cabinets, including lengths, heights, and aisle layout, and relationship to adjacent construction.
 - 1. Indicate methods of achieving specified anchoring requirements.

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- D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in District's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inspect for dents, scratches, or other damage. Replace damaged units.
- B. Store in manufacturer's unopened packaging until ready for installation.
- C. Store under cover and elevated above grade.

1.07 WARRANTY

- A. Provide one year manufacturer warranty covering defects of manufacturing and workmanship and rust and corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Shelving:
1. Lyon LLC www.lyonworkspace.com/#sle
 2. Vestil: www.vestil.com
 3. Tennsco Storage: www.tennsco.com/#sle.
 4. Jarke: www.jarke-mf.com
- B. Mesh Storage Cabinets:
1. Little Giant: www.littlegiant-usa.com/#sle.
- C. Racks:
1. Tennsco Storage: www.tennsco.com/#sle.
 2. Jarke: www.jarke-mf.com
 3. Vestil: www.vestil.com
- D. Safety Cabinets:

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1. Justrite: www.justrite.com/#sle.

2.02 SHELVING AND RACKS - GENERAL

- A. See drawings for layout and sizes.
- B. Anchors: Provide anchoring hardware to secure each shelving unit to floor.
 1. Provide hardware of type recommended by manufacturer for substrate.
 2. See drawings for additional details of anchorage.

2.03 BULK STORAGE SHELVING (MS)

- A. Welded Frame Bulk Shelving: Welded steel end frames with sway bracing.
 1. Shelf Depth: 24 inches, and 12 inches as indicated.
 2. Unit Width: Widths as indicated on plans.
 3. Shelf Capacity: 1,100 lbs/shelf, minimum
 4. Shelf Deflection: 1/4 inch in 36 inches, maximum, under specified uniform load.
 5. Adjustability of Shelving: At intervals of 1 1/2 inches on center.
 6. Shelves per Unit: Top, bottom, and 2 intermediate adjustable shelves.
 7. Unit Height: 84 inches, overall , maximum.
 8. Finish: Powder coated finish.
 9. Color: Manufacturer's standard gray.
 10. Number of Units: As indicated on drawings.
- B. Posts: Formed sheet members; perforations may be exposed on face of members.
 1. Metal Thickness: 14 gauge, 0.0747 inch.
 2. Post Shape: Tee intermediate posts, angle end posts forming corners.
 3. Post Face Width: 2 inches, maximum.
 4. Connecting Hardware: Manufacturer's standard.
 5. Post Bases: Flat steel foot plate , with manufacturer's recommended adjustable leveling device.

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C. Bracing:

1. Strap Sway Bracing: One strap installed diagonally, welded to each end panel assembly.

D. Shelves: Minimum 5/8 inch thick medium-density fiberboard.

1. "Z" beam front and back supports: 14 gauge formed steel beam continuous front and back edges of each shelf. Each end of the beam has 3 studs to engage beam clips.
 - a. Beam clips MIG welded to end panel uprights.
 - b. Lock tab to protect against displacement.
2. Intermediate front-to-back supports: Two per shelf.
3. Shelf Connection to End Panels: Manufacturer's standard.

2.04 FULLY VENTILATED STORAGE CABINETS (MC)

A. Storage Cabinets: Steel mesh sides and backs, with expanded metal panels and doors.

1. Unit Width: 48 inches, overall.
2. Adjustability of Shelving: At intervals of 3 1/2 inches maximum on center; removable.
3. Shelf Depth: Nominal 3 inches less than cabinet depth, minimum.
4. Unit Depth: 30 and 36 inch depths as indicated on drawings.
5. Shelves per Unit: 3.
6. Unit Height: 78 inches, overall .
7. Finish: Powder coated.
8. Color: Manufacturer's standard gray.
9. Number of Units: As indicated on drawings.

B. Case Construction: Formed sheet metal comprising vertical support members, panel and door frames.

1. Shelf Support Members: Manufacturer's standard profile.
2. Face Width of Exposed Vertical Supports: 2 inches, maximum.

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3. Panels: 14 gauge, frame minimum with 13 gauge expanded metal infill panels 3/4" x 1-3/4" diamond-shaped openings.
 4. Connecting Hardware: Fully welded.
 5. Base: 4 inch high open base, finished to match cabinet.
- C. Shelves: Formed sheet metal, finished on all surfaces.
1. Thickness: 14 gauge, minimum.
 2. Shelf Edge Profile: Manufacturer's standard.
 3. Provide raised edge lip on all shelves; height 2 inches.
 4. Shelf Connection: Bolts.
- D. Cabinet Doors: Manufacturer's standard welded steel. 270 degree opening.
1. Style: 13 gauge expanded metal infill panels 3/4" x 1-3/4" diamond-shaped openings finished to match cabinet.
 2. Hinges: 5/16 inch Four-knuckle type.
 3. Handles: Slide hasp, one on right hand side door.
 4. Locks: Padlock.

2.05 CANTILEVERED RACKS (MR)

- A. Compact, standard-duty, modular adjustable-arm cantilever rack suited for installations that require storage of plastics, conduit, extrusions, hydraulic tubing, and similar lightweight materials.
- B. Manufacturer: Vestil SU-C-6-24
1. Nominal Height: 72 inches
 2. Nominal Width: 36 inches
 3. Nominal Depth (Base): 37 inches
 4. Arms: 4 pairs, 24 inch length
 5. Total Capacity: 3,800 pounds
 6. Frame Components: 14 gauge minimum steel profiles, powder coated.

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2.06 VERTICAL RACKS (MH)

A. Wall Mounted Tool Racks:

1. Manufacturer: Gempler's #HR12 Long-Handled Tool Rack.
2. Heavy-duty tool rack consisting of two cantilevered 12 inch long 16 gauge tubular steel tines; fully welded to a rectangular mounting plate with two 3/8"-dia. holes for attachment to solid backing.
3. Finish: Powder-coated

2.07 SAFETY STORAGE CABINETS

A. All door styles shall meet OSHA and NFPA 30;

1. Self-close door styles also meet NFPA 1 and the International Fire Code.

B. All cabinets shall be 30-minute fire resistance rated and FM approved.

C. Warranty: 10 years.

D. Cabinet construction: Melamine resin and flame-retardant special plates, and a steel door front covered by a textured, durable powder-coat finish. Under fire conditions, intumescent strips shall expand and hermetically seal all gaps to reduce heat entering the cabinet, providing 30 minutes of content protection and extended evacuation time.

E. Hybrid style door(s) open or close manually and include a damper that adjusts the force needed to move the door(s). In the event of a fire, the built-in fusible link system releases to allow automatic closure of door(s) at 122°F (50°C).

F. Sloped galvanized steel shelves shall be designed to direct spills to back and bottom of a leakproof sump.

G. Shelves: Adjustable on 1 1/4 in. centers.

1. Shelf capacity 165 pounds
2. 1 inch high ledge

H. Dual vents with flame arresters

I. Four adjustable self-leveling feet,

J. Grounding connector.

K. Reflective trilingual warning label.

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- L. Finish: Chemical-resistant, lead-free epoxy/polyester powder-coat finish.
- M. Paint Storage Cabinet (Class III combustibles):
 - 1. Basis of Design Product: Justrite 22603 30-minute rated Safety Cabinet.
 - 2. Capacity: 45 gallons
 - 3. Color: Standard safety yellow.
 - 4. Doors: 2
 - 5. Adjustable Shelves: 5
 - 6. Exterior Dimensions: 46 inches wide x 24 inches deep x 76 inches high.
- N. Flammable Safety Cabinet:
 - 1. Basis of Design Product: Justrite 22601 30-minute rated Safety Cabinet.
 - 2. Capacity: 30 gallons
 - 3. Color: Standard safety yellow.
 - 4. Doors: 1
 - 5. Adjustable Shelves: 3
 - 6. Exterior Dimensions: 34 inches wide x 24 inches deep x 76 inches high.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate is level and that clearances are as specified.
- B. Do not begin installation until substrates have been properly prepared.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Anchor and reinforce as specified, as indicated on drawings, and as recommended by manufacturer.

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- C. Install shelving with shelf and rack arm surfaces level and vertical supports plumb, except where sloped units are indicated; adjust feet and bases as required.
- D. Out-Of-Square Tolerance - Four Post Shelving: Maximum of 1/8 inch difference in distance between bottom shelf and top, measured along any post in any direction.

3.03 CLEANING

- A. Clean shelving and surrounding area after installation.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 11 52 00 - AUDIO VISUAL EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Monitor Mounts: Wall mounts for monitors.
- B. Wall-mounted projection surfaces.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 10 11 00 - Visual Display Surfaces: Standard marker boards.
- C. Refer to Drawings for projector specifications.

1.03 COORDINATION

- A. Coordinate layout and installation of equipment mounts with adjacent construction, including ceiling , light fixtures, HVAC equipment, fire-suppression system, and partitions.

1.04 ACTION SUBMITTALS

- A. Product Data: Materials description and operating instructions.
- B. Shop Drawings:
 - 1. For monitor mounts include the following:
 - a. Anchorage details.
 - b. Accessories.
 - c. Copy of current Equipment Anchorage Pre-Approval (OPA) issued by the California Office of Statewide Health Planning and Development for each monitor mounting component.
 - 2. For projection surfaces include the following:
 - a. Anchorage details.
 - b. Accessories.
 - c. Details for coordination with mounting of short throw projector.

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Issue for Bid		Audio Visual Equipment

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PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable 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. Chief Manufacturing.
 2. Epson.

2.02 WALL MOUNTING BRACKETS FOR MONITORS AND DISPLAYS

- A. Black metal, micro-adjustable tilt wall type, conforms to CBC and ASCE 7, pre-approved by California Office of Statewide Health Planning and Development:
1. LeGrand, Chief Manufacturing, "XTM1U" Fusion Series extra-large monitor mount. for monitors up to 100 inch diagonal.

2.03 WALL MOUNTED PROJECTION SURFACES

- A. Combined projection and dry-erase surface. Magnetic.
1. Epson Model V12H831000.
 2. Dimensions: 54.5 inches high x 86.6 inches wide x 1 inch deep providing up to 100 inch diagonal projection surface. 16:10 aspect ratio.
 3. Weight: 95 pounds.
 4. Matte white low-gloss surface to minimize glare and reflection.
 5. Thin-bezel design compatible with short-throw projector mount.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify size and weight of audio-visual units to be mounted with Owner prior to ordering mounting brackets.

3.02 INSTALLATION

- A. Install audio-visual equipment according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.

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B. Secure wall brackets to building construction as follows:

1. For wood-framed gypsum board assemblies, use hanger or lag bolts set into solid support backing between studs using self-tapping screws of size and type required to support structural loads. Coordinate with stud installation to locate backing members.

C. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing audio-visual units and for properly transferring loads to in-place construction.

D. Install units to withstand a downward load of at least 150 lbf.

E. Secure units to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.

3.03 ADJUSTING

A. Adjust units to ensure plumb installation. Replace damaged or defective items.

B. Removing temporary labels and clean units strictly according to manufacturer's recommendations.

C. Touchup Painting: Immediately after erection, clean bolted connections and abraded areas, and paint exposed areas with same color in order to return surfaces to like-new condition.

D. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

3.04 CLEANING

A. Construction Waste Management: Manage construction waste in accordance with provisions of Section 017419 Construction Waste Management and Disposal.

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SECTION 12 21 13 - HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Horizontal slat louver blinds.
- B. Operating hardware.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 12 24 00 - Window Shades: Manual and electrically operated roller window shades.

1.03 REFERENCE STANDARDS

- A. WCMA A100.1 - Safety of Window Covering Products 2018.

1.04 SUBMITTALS

- A. Product Data: Provide data indicating physical and dimensional characteristics.
- B. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.
- C. Samples: Submit two samples, minimum 6 inch long illustrating slat materials and finish, cord type and color.
- D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- E. Maintenance Materials: Furnish the following for District's use in maintenance of project.
 - 1. Extra Blind Assemblies: One of each size.
 - 2. Extra Slats: 20 of each type and size.
 - 3. Extra Lift Cords, Control Cords, and Wands: One of each type.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Horizontal Louver Blinds:
 - 1. Hunter Douglas Architectural; Everwood: www.hunterdouglasarchitectural.com/#sle.
 - 2. Levolor; Faux Wood Blinds: www.levolor.com/commercial/#sle.
- B. Source Limitations: Furnish blinds and associated controls produced by a single manufacturer and obtained from a single supplier.

2.02 BLINDS

- A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.
- B. Manual Operation: Control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.
- C. Plastic Slats: Polymer composite, square slat corners.
 - 1. Width: 2 inch.
 - 2. Color: As selected by Architect.
 - 3. Texture: Smooth.
- D. Slat Support: Woven polypropylene cord, ladder configuration.
- E. Head Rail: Pre-finished, formed steel box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.
 - 1. Height: approximately 1 1/2 inches.
 - 2. Color: Same as slats.
 - 3. Fascia: Contemporary flush profile, color to match slats.
- F. Bottom Rail: Pre-finished, formed polymer composite; with end caps.
 - 1. Color: Same as headrail.
- G. Lift Cord: Braided nylon; continuous loop; complying with WCMA A100.1.
 - 1. Free end weighted.
 - 2. Color: Match slats..

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H. Control Wand: Extruded hollow plastic; hexagonal shape.

1. Non-removable type.
2. Length of window opening height less 3 inch.
3. Color: Clear.

I. Headrail Attachment: Wall brackets.

2.03 FABRICATION

- A. Determine sizes by field measurement.
- B. Fabricate blinds to fit within openings with uniform edge clearance of 1/4 inch.
- C. Fabricate blinds to cover window frames completely.
- D. At openings requiring multiple blind units, provide separate blind assemblies with space of 1/4 inch between blinds, located at window mullion centers.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings are ready to receive the work.

3.02 INSTALLATION

- A. Install blinds in accordance with manufacturer's instructions.
- B. Secure in place with flush countersunk fasteners.
- C. Place intermediate head supports at a maximum of 36 inch on center.

3.03 TOLERANCES

- A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.
- B. Maximum Offset From Level: 1/8 inch.

3.04 ADJUSTING

- A. Adjust blinds for smooth operation.

3.05 CLEANING

- A. Clean blind surfaces just prior to occupancy.

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- B. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

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SECTION 12 24 00 - WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manual roller shades and accessories.
- B. Motorized roller shades and accessories.
- C. Motor controls, interfaces, and accessories.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films 2019.
- C. UL (GGG) - GREENGUARD Gold Certified Products Current Edition.
- D. WCMA A100.1 - Safety of Window Covering Products 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
- B. Sequencing:
 - 1. Do not fabricate shades until field dimensions for each opening have been taken with finished conditions in place. "Hold to" dimensions are not acceptable.
 - 2. Do not install shades until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. CALGreen Submittals: Provide the following:

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1. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product to be used including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- C. Shade Schedule: Use same room designations as indicated on the Drawings, field verified window dimensions, quantities, type of shade, controls, fabric, and color,
- D. Shop Drawings:
 1. Head jamb and sill details.
 2. Motorized Shades: Include one-line diagrams, wire counts, coverage patterns, and physical dimensions of each item. Include location plan showing all switch and control zones, switches, sensors and other control accessories.
- E. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.
- F. Selection Samples: Include fabric samples in full range of available colors and patterns.
- G. Verification Samples: Minimum size 12 inches square, representing actual materials, color and pattern.
- H. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- I. Project Record Documents: Record actual locations of control system components and show interconnecting wiring.
- J. Operation and Maintenance Data: List of all components with part numbers; include copy of shop drawings.
 1. Precautions regarding cleaning materials and methods,
 2. Instructions for operation and maintenance of hardware and controls
- K. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in District's name and registered with manufacturer.
- L. Maintenance contracts.

1.06 QUALITY ASSURANCE

- A. Motorized Shades: Comply with NFPA 70.

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- B. NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use.
- C. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.
- D. Installer Qualifications: Company specializing in performing work of this type with minimum ten years of documented experience with shading systems of similar size, type, and complexity; manufacturer's authorized representative.

1.07 MOCK-UP

- A. Mock-Up: Provide full size mock-up of window shade system complete with selected shade fabric including example of seams or as required to simulate jobsite conditions when applicable.
 - 1. Obtain Architect's approval of light and privacy characteristics of fabric prior to fabrication.
 - 2. Full-sized mock-up may become part of the final installation.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

1.09 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

- A. Provide manufacturer's standard, non-depreciating warranty, for interior shading only, covering the following:
 - 1. Shade Hardware: 25 years unless otherwise indicated.
 - 2. Shade Fabric: 25 years unless otherwise indicated.
 - 3. Electric Motors, Controls, and Accessories: Five years.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: MechoShade Systems LLC; www.mechoshade.com/#sle.
- B. Other Acceptable Manufacturers:
 - 1. Draper Inc. Clutch-Operated FlexShade NEXD..
 - 2. Nysan Hunter Douglas..
 - 3. Products by listed manufacturers are subject to compliance with specified requirements.

2.02 ROLLER SHADES

- A. General:
 - 1. Provide shade system components that are capable of being removed or adjusted without removing mounted shade brackets or cassette support channel.
 - 2. Provide shade system that operates smoothly when shades are raised or lowered.
 - 3. Electrical Components: Listed, classified, and labeled as suitable for the purpose intended. Individual testing of components will not be acceptable in lieu of system testing. Where applicable, system components to be FCC compliant.
- B. Accessories:
 - 1. Fascia Box: Removable extruded aluminum fascia box with closed top, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; baked enamel finish.
 - a. Fascia box to be capable of installation across two or more shade bands in one piece.
 - b. Provide single fascia box to accommodate shades.
 - c. Color: White.
 - d. Profile: Square.
 - e. Configuration: Captured and continuous.

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2.03 MANUALLY OPERATED WINDOW SHADES

- A. Heavy-Duty Manually Operated Window Shades with Independent Control: Manually operated, vertical roll-up, fabric window shade with components necessary for complete installation.
1. Operation: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far.
 - a. Clutch mechanism: Fabricated from POM thermoplastic with welded 0.354 inch (9 mm) primary steel post with rotational bearing, overrunning design, and positive mechanical engagement of drive mechanism to tube. White or Black color as selected by Architect. Center bead chain placement for right or left hand operation and accommodates side channel with no adjustment of chain location.
 - b. Bead chain loop: 120 Lb. Stainless steel bead chain.
 - c. Bead Chain Hold Down: Spring-Loaded Tensioner complying with ANSI/WCMA A100.1-2018 safety standard.
 2. Single Roller Configuration:
 - a. Mounting: Endcaps and headbox.
 - b. Headbox Ceiling/Wall style: Aluminum fabrication with a top/back cover and fascia with endcaps for mounting:
 - c. Finish: Standard manufactures choice of (5) colors as selected by the Architect.
 3. Rollers: Extruded aluminum roller tube of appropriate diameter to support shade fabric with minimal deflection.
 - a. Minimum Roller Tube Diameter: 1.25 inches (32 mm).
 - b. Fabric Connection to Roller Tube: Fabric connected to the roller tube with LSE (low surface energy) double sided adhesive
 - c. Fabric Length: 6 inches (152 mm) greater than window height minimum.
 - d. Hembar: Machine extruded aluminum.

2.04 MOTORIZED WINDOW SHADES

- A. Shade Motor and Control System

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1. Standard Motor: 120V AC, single phase, 60 HZ, instantly reversible, lifetime lubricated, and equipped with internal thermal overload protector, electric brake, and pre-set accessible limit switches. Tubular motor concealed inside each shade roller tube.
2. Individual Control:
 - a. Wall Switch – DP/DT Toggle three position wall switch.
- B. Roller: Fabricated from extruded aluminum or steel. Wall thickness and material selected by manufacturer to accommodate shade size. Provide with roller idler assembly of molded nylon and zinc-plated steel pin. Sliding pin to allow easy installation and removal of roller. Fabric connected to the roller tube with LSE (low surface energy) double sided adhesive specifically developed to attach coated textiles to metal. Adhesive attachment to eliminate horizontal impressions in fabric.

2.05 SHADE FABRIC

- A. Fabric for Light Filtering Shades and Room Darkening Shades: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
 1. Apagon Style III: 3-ply opaque coated fabric consisting of vinyl and fiberglass.
 - a. GREENGUARD Gold. Manufacturer to supply GREENGUARD Gold certificate.
 - b. Fire rating: CBC/CFC 806.4 Flame Resistant in accordance with CCR, Title 19, Division 1, Chapter 8.
 - c. Apagon Style III - 1 percent open.
 - d. Color: Gray/Gray
 2. SheerWeave Series SW2703: Duplex basketweave fabric-light exterior color combined with dark interior color for thermal comfort and view-through.
 - a. GREENGUARD Gold. Manufacturer to supply GREENGUARD Gold certificate.
 - b. Fire rating: CBC/CFC 806.4 Flame Resistant in accordance with CCR, Title 19, Division 1, Chapter 8.
 - c. SW2703-P91 - 3 percent open.
 - d. Color: Oyster/Pewter.
 3. Material Certificates and Product Disclosures:
 - a. Low-Emitting Material Certification: Greenguard Gold certified and listed in UL (GGG).

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B. Fabric for Room-Darkening Shades

1. SunBloc Series SB9000: Close woven fiberglass base textile with sun-resistant vinyl film bonded to each side, opaque with minimum tensile strength of 190 pounds for warp and 180 pounds for fill.
 - a. Flammability: CBC/CFC 806.4 Flame Resistant in accordance with CCR, Title 19, Division 1, Chapter 8.
 - b. Washable and stain resistant.
 - c. Weight: 12 oz/sq yd.; .015 inches thick.
2. Color: As selected by Architect from manufacturer's full range of room darkening fabrics. Same color both sides.

C. Fabrication:

1. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.
 - a. Battens: Manufacturer's standard material, full width of shade, and enclosed in welded shade fabric pocket; locate as indicated on drawings.
 - b. Seams for Railroaded Fabric: Manufacturer's standard sewn seam; locate as indicated on drawings.

2.06 MOTOR CONTROLS

- A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.
- B. Provide all components and connections necessary to interface with other systems as indicated.
- C. Low-Voltage Wall Controls; IQ Switch:
 1. Momentary dry contact switch enables manual local control or network control of any individual shade motor or shade group/sub-group on MechoNet network.
 2. Control Functions:
 - a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.
 - b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.

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- c. Presets: For selection of predetermined shade positions.
 - d. Dual Stations: For individual control of two shades/groups.
- 3. Finish: White.
- 4. Products:
 - a. Single station, 5-button (open, close, and three intermediate stop positions).
 - b. Double station, 10-button (open, close, and three intermediate stop positions for each of two shades/groups).

2.07 FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
 - 1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
 - 2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
 - 3. Horizontal Dimensions - Outside Mounting: Cover window frames, trim, and casings completely.
- C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Replace shades that exceed specified dimensional tolerances at no extra cost to District.

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- C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.03 SYSTEM STARTUP

- A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.04 CLEANING

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.
- C. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

3.05 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate operation and maintenance of window shade system to District's personnel.
- B. Training: Train District's personnel on operation and maintenance of system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the District.

3.06 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

3.07 MAINTENANCE

- A. Provide to District, a proposal as an alternate to the base bid, a separate renewable maintenance contract for the service and maintenance of a motorized shade system for one year from date of Substantial Completion. Include a complete description of preventive maintenance, systematic examination, adjustment, parts and labor, cleaning, and testing, with a detailed schedule.

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SECTION 12 36 00 - COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.
- B. Concrete countertops.
- C. Stainless steel countertops.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 01 81 13 - Sustainable Design Requirements: Requirements for certified wood and low-emitting materials.
- C. Section 06 20 00 - Finish Carpentry: for removed and re-installed wood-block countertops
- D. Section 06 41 00 - Architectural Wood Casework :
- E. Section 09 30 00 - Tiling: Tile for countertops.
- F. Section 22 40 00 - Plumbing Fixtures: Sinks, lavatories, and fittings

1.03 REFERENCE STANDARDS

- A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- B. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2019.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2018).
- E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.
- F. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material 2013.
- G. MIA (DSDM) - Dimensional Stone Design Manual, Version VIII 2016.

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- H. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- I. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII 2016.
- J. PS 1 - Structural Plywood 2009.
- K. WI (CCP) - Certified Compliance Program (CCP) Current Edition.

1.04 SUBMITTALS

- A. CALGreen Submittals: Provide product data to demonstrate that adhesives, sealants, and caulks used on the project meet the requirements of the following standards:
 - 1. TABLE 5.504.4.1 - ADHESIVE VOC LIMIT; TABLE 5.504.4.2 - SEALANT VOC LIMIT included in Section 01 81 13 - Sustainable Design Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
 - 1. Shop drawings must include all proposed seam locations.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- G. Installation Instructions: Manufacturer's installation instructions and recommendations.
- H. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

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B. Quality Certification:

1. Comply with WI (CCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section:
www.woodworkinstitute.com/#sle.
2. Provide labels or certificates indicating that the installed work complies with AWMAC/WI (NAAWS) requirements for grade or grades specified.
3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Concrete Countertops: Precast concrete; top and edges formed against melamine-finished mold; jointing as indicated on drawings; sanded and polished.
 1. Dimensions: As indicated on drawings.
 2. Thickness: 1-1/2 inches.
 3. Color Additive: Custom color to match sample provided by Architect..
 4. Sealer: Low gloss penetrating silane/siloxane, transparent.

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5. Construct forms with required inserts and knock-outs and support to remain in place through curing.
6. Concrete Mix: Non-shrinking, machine-mixed commercial grade concrete mix for casting countertops, requiring only the addition of water.
 - a. Manufacturers:
 - 1) The QUIKRETE Companies. quikrete.com/#sle.
 - 2) Accepted equal.
 - b. Compressive Strength: 4000 pounds per square inch, minimum, at 28 days.
- C. Stainless Steel Countertops: ASTM A666, Type 304, stainless steel sheet; 16 gage, 0.0625 inch nominal sheet thickness.
 1. Manufacturers:
 2. Finish: 4B satin brushed finish.
 3. Edge and Backsplash Sink Details: As indicated on drawings.
 4. Exposed Edge Shape: Straight turndown with return; 1-1/2 inch high face, 1/2 inch return to face of case ; reinforced with hardwood or steel.
 5. Back and End Splashes: Same material; welded 1/4 inch radius coved joint to countertop; square top edge with 1 inch wide top surface and minimum 1/2 inch turndown.
 - a. Splash Dimensions: 1 inch thick, unless otherwise indicated.
 - 1) Splash height as shown on drawings:
 - (a) 4" height at low splash
 - (b) 22" height at high splash unless otherwise indicated.
 6. Splash Depth Where Faucets are Mounted in Splash: 2 inches.
- D. Solid Surface: Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
 1. Flat Sheet Thickness: 3/4 inch, minimum.
 2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard

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stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.

a. Manufacturers:

- 1) Cosentino; "Eco Line" is basis of design; www.cosentino.com. San Francisco contact Danielle Johnson 415-713-4577.
- 2) Cambria Company LLC: www.cambriausa.com/#sle.
- 3) Seieffe Corporation; OKITE®: www.okite.us/#sle.

b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).

c. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.

d. Color and Pattern: As selected by Architect from manufacturer's full line.

- 1) Eco Line colors: To be selected from manufacturer's standard range.
- 2) Finish: Suede.
- 3) Alternate product may be submitted subject to Architect's determination of match to selected color.

3. Other Components Thickness: 3/4 inch, minimum.

4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge.

5. Back and End Splashes: Same sheet material, square top

- a. 4" high at low splashes
- b. 22" high at high splashes unless as otherwise indicated .

6. Skirts: As indicated on drawings.

7. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

2.02 MATERIALS

A. Extruded Aluminum: ASTM B211/B211M, 6463 alloy, T5 temper.

B. Wood-Based Components:

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1. Wood fabricated from old growth timber is not permitted.
2. Provide sustainably harvested wood, certified or labeled as specified in Section 01 81 13 - Sustainable Design Requirements.
- C. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- E. General Requirements for Joint Sealants and Adhesives: Conform with requirements of Section 01 81 13 - Sustainable Design Requirements for certified low-emitting materials.
- F. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 ACCESSORIES

- A. Grommets: Standard painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.04 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 1. Join lengths of tops using best method recommended by manufacturer.
 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
 - a. Rout a 1/8 inch drip groove at underside of exposed overlapping edges, set back 1/2 inch from face of edge.
 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

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- D. Stainless Steel: Fabricate tops up to 144 inches long in one piece including nosings and back and end splashes; accurately fitted mechanical field joints in lengths over that dimension are permitted.
1. Weld joints; grind smooth and polish to match.
 - a. All finished seams to be flush with the surface and watertight.
 2. Provide stainless steel hat channel stiffeners, welded or soldered to underside, where indicated on drawings.
 3. Provide wall clips for support of back/end splash turndowns.
 4. Sound Deadening: Apply water resistant, fire resistant sound deadening mastic to entire bottom surface.
 5. Integral sinks: Fabricate with corners rounded and coved, double-walls for sink compartment partitions, and drainboards. Factory-punch holes for fittings, and weld sinks to countertops.
- E. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

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- B. Attach stainless steel countertops using stainless steel fasteners and clips.
- C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

- A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 12 48 13 - ENTRANCE FLOOR MATS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet mat.

1.02 SUBMITTALS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Product Data: Provide data indicating properties of walk-off surface, component dimensions.
- C. Shop Drawings: Indicate dimensions.
- D. Samples: Submit two samples, 12 by 12 inch in size illustrating pattern, color, finish, and edging.
- E. Maintenance Data: Include cleaning instructions, and stain removal procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Floor Mats:
 - 1. Construction Specialties, Inc; Design Step: www.c-sgroup.com/#sle.
 - 2. Nystrom, Inc; MATrac: www.nystrom.com/#sle.
 - 3. Pawling Corporation: www.pawling.com/#sle.

2.02 MATS

- A. Carpet Mat: Cut nylon pile permanently bonded to vinyl backing; sizes as shown on drawings with one inch matching vinyl border on all edges.
 - 1. Colors: To be selected by Architect from manufacturer's full range.

2.03 FABRICATION

- A. Fabricate mats in single unit sizes; fabricate multiple mats where indicated on drawings.

END OF SECTION

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SECTION 12 93 00 - SITE FURNISHINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Picnic table and benches.
- B. Benches.
- C. Bicycle racks.
- D. Drinking fountain.
- E. Bottle filler.
- F. Wheelchair accessible raised vegetable bed.
- G. Festival string lights.

1.03 RELATED REQUIREMENTS

- A. Section 03 30 00 – Cast-in-Place Concrete, for footings.
- B. Section 13 12 13 – Exterior Fountains, for garden water features.
- C. Section 32 13 14 – Landscape Concrete Paving, for concrete pads.
- D. Section 32 14 00 – Unit Paving, for concrete unit surfacing.
- E. Section 32 14 43 – Porous Unit Paving, for crushed rock surfacing.
- F. Section 32 15 41 – Aggregate Paving with Admixture, for adjacent paving.
- G. Division 26 – Electrical, for electrical connection to festival string lights.

1.04 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2018.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

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- E. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings 2018.
- F. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2012.

1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's specifications and descriptive literature including type or model, color, finish, size, installation instructions, and maintenance information.
- B. Shop Drawings: If required per drawings, submit fabricator plans for each unit or groups of units, elevations with model number, overall dimensions; construction, and anchorage details.

1.06 WARRANTY

- A. Provide manufacturer's warranty against defects in materials or workmanship for ductile iron castings for a period of 10 years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS AND PRODUCT INFORMATION

- A. Picnic Table and benches – Refer to Drawings.
- B. Benches – Refer to Drawings.
- C. Bicycle Racks – Refer to Drawings.
- D. Drinking Fountain – Refer to Drawings.
- E. Bottle Filler – Refer to Drawings.
- F. Wheelchair Accessible Raised Vegetable Bed – Refer to Drawings.
- G. Festival String Lights – Refer to Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that mounting surfaces, preinstalled anchor bolts, or other mounting devices are properly installed; and ready to receive site furnishing items.
- B. For type of required anchor, consult drawings for connection specified or review manufacturer recommendations.
- C. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

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- A. Install site furnishings per approved shop drawings or manufacturer's installation instructions.
- B. Provide level mounting surfaces for site furnishing items.
- C. Sequencing and scheduling: Install surface-mounted and surface-placed site furnishing after paving has been completed and cured.
- D. Installation of picnic table and seats must be in compliance with current ADA standards.

END OF SECTION

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SECTION 13 12 13 - EXTERIOR FOUNTAINS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Work of this section is part of an Alternate bid.

1.02 SECTION INCLUDES

- A. Prefabricated recirculating garden water fountains and fountain accessories.

1.03 RELATED REQUIREMENTS

- A. Section 01 23 00 – Alternates.
- B. Section 03 30 00 – Cast-in-Place Concrete, for footings.
- C. Section 32 84 00 – Irrigation, for water pipe stub-outs.
- D. Division 22 – Plumbing Piping, for piping, valves, and fittings.
- E. Division 26 – Electrical, for electrical connections.
- F. Division 33 – Utilities.
- G. Section 33 10 00 – Site Water Systems.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. Product Data: Provide cut sheets for all fountain water system components and related accessories.
- B. Shop Drawings: Provide for each fountain water system, including pump locations.
- C. Samples:
 - 1. Submit precast concrete samples of each water fountain basin, illustrating surface finish, color, and texture.
 - 2. Submit minimum two photos of each stone fountain to be purchased. Indicate type of stone, height and diameter.
- D. Manufacturer's Installation Instructions: Indicate special installation procedures.

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- E. Installer's Qualification Statement.
- F. Operation Data: Provide operating instructions to Owner.
- G. Maintenance Data: Provide maintenance instructions and schedules to Owner.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 WARRANTY

- A. Correct defective Work within a five year period after Date of Substantial Completion.
- B. Provide five year manufacturer warranty for each outdoor water fountain.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Water Fountains: As indicated on Drawings

2.02 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for outdoor water fountains and associated equipment.

2.03 PIPE AND FITTINGS

- A. Exposed Piping: Copper Type L as specified in Division 22.
- B. Concealed Piping: Copper Type L as specified in Division 22.
- C. Valves and Fittings: Per Fountain Manufacturer's recommendations. Refer to Division 22.

PART 3 EXECUTION

3.01 EXAMINATION AND SEQUENCING

- A. Verify excavation surfaces are clean, smooth, and without voids or irregularities.
- B. Verify adequate water and electrical connections are in place.
- C. Verify lead time for fabrication and delivery of each fountain will not cause installation delays.

3.02 INSTALLATION

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- A. Exact locations of water fountains to be approved by Landscape Architect and Owner in field prior to installation.
- B. Install prefabricated water fountains to final assembly in accordance with manufacturer's instructions.
- C. Lock components into position, level and plumb.
- D. Coordinate installation of mechanical and electrical components; connect to utilities.
- E. Fill fountains, activate filtration and circulation equipment, and verify all components are functioning properly. Immediately correct any and all deficiencies.
- F. Install fountain accessories and fittings in accordance with component manufacturer's instructions.

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SECTION 13 34 13 - GREENHOUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Greenhouses
 - 1. Design and calculations prepared and sealed by a Structural Engineer licensed in the State of California.
 - 2. Greenhouse structures and enclosures.
- B. Accessories including but not limited to:
 - 1. Vents.
 - 2. Fans.
 - 3. Motors.
 - 4. Evaporative pads.
 - 5. Shutters.
 - 6. Heating systems.
 - 7. Environmental controls.
 - 8. Growth lights.
 - 9. Plant watering systems.
 - 10. Bench Systems.
- C. Glazing.
- D. **Refer to PART 4 for description of additional equipment to be provided as Alternate Bid 2.**

1.02 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 03 30 00 – Cast-In-Place Concrete: Cast-in-place concrete foundations, slabs, and walls.

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- C. Section 07 92 00 – Joint Sealers.
- D. Section 08 43 13 – Aluminum-Framed Entrances and Storefront: Aluminum-framed entrances.
- E. Section 08 71 00 - Door Hardware: Hardware for aluminum-framed entrances.
- F. Section 08 80 00 - Glazing: Plastic glazing for interior gate and screen.
- G. Division 21, 22 and 23 – Fire Protection, Plumbing and Mechanical: Provision of and connection to services not specified in this section.
- H. Division 26 and 27 – Electrical and Telecommunications: Provision of and connection to services not specified in this section.

1.03 REFERENCES

- A. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum.
- B. ASCE 7 - American Society of Civil Engineers Standard Minimum Design Loads for Buildings and Other Structures.
- C. ASTM A 36/A 36M – Standard Specification for Carbon Structural Steel.
- D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- E. ASTM B 308/b 308M – Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
- F. ASTM C 864 – Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- G. AWS D1 – Structural Welding Code.
- H. California Code of Regulation Title 24 Part 2, California Building Code - most current Edition.
- I. NGMA - National Greenhouse Manufacturer's Association, Standards - most current Edition.

1.04 DESIGN CRITERIA

- A. Structural calculations for greenhouses have been signed and sealed by Structural Engineer licensed in the State of California.
- B. Structural Performance: Except as noted, and at the minimum, conform to the requirements and recommendations of both the “Standard for Design Loads in Greenhouse Structures”

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and its "Commentary" published by the National Greenhouse Manufacturers Association, (NGMA Standards).

C. Greenhouse frame shall be designed in accordance with the American Institute of Steel Construction Specifications, American Iron and Steel Institute Specifications and the California Building Code.

D. Design Loads

1. Design structure to carry the following loads:

- a. Dead Load: Structure and Equipment
- b. Ground Snow Load: 0 lbs./sq. ft.
- c. Wind Speed: 92 mph, exp. C
- d. Special Loads: (If Applicable) : Not Applicable
- e. Applicable Building Code is the California Building Code and ASCE 7.

1) Load Combinations per ASCE 7:

(a) Allowable Strength Design:

- (1) $D + L_r$
- (2) $D + W$
- (3) $0.6D + W$
- (4) $D + 0.7E$
- (5) $D + 0.75L_r + 0.75W$
- (6) $D + 0.75L_r + 0.75(0.7E)$

(b) Load and Resistance Factor Design:

- (1) $D + 1.6L_r$
- (2) $0.9D + 1.6W$
- (3) $0.9D + 1.0E$
- (4) $1.2D + 1.6L_r + 0.8W$
- (5) $1.2D + 1.6W + 0.5L_r$

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(6) 1.2D + 1.0E + 0.2S

2. Engineering Certification

- a. Provide written structural analysis prepared and certified by a Structural Engineer licensed in the State of California, that the greenhouse meets the above-specified loads.

1.05 SUBMITTALS

- A. General: Comply with provisions of Division 01 of these specifications.
- B. Product data: Within 30 days after award of the contract, submit Manufacturer's product specifications, technical product data, standard data, and installation recommendations for each component.
- C. Shop drawings: Submit shop drawings for fabrication and installation of greenhouse, including the following:
 1. Elevations.
 2. Detail section of typical framing members.
 3. Hardware, mounting heights.
 4. Anchorage and reinforcements.
 5. Glazing details.
 6. Placement of all components for heating, cooling, and ventilation.

1.06 GENERAL

- A. Design Submittal included in Construction Documents: For systems indicated to comply with performance requirements and design criteria, all applicable codes and standards, and approval by the Architect, including analysis data signed and sealed by the qualified Structural engineer licensed in the State of California responsible for their preparation.
 1. Detail fabrication, assembly, and connections of aluminum-framed systems.
 2. Detail all connections to building structure.
 3. Structural design calculations based on the design criteria shown in the structural drawings.
- B. It is the intent of this portion of the specifications to include the furnishing and erection of the greenhouse superstructure including all glazing, equipment and ventilation as shown on

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plans and/or hereinafter described such work to be the responsibility of the Greenhouse Manufacturer. Greenhouse installation is the responsibility of the Greenhouse Manufacturer and shall be included with bid on bid day. Material only bids will not be accepted. Bids received after the bid date shall be considered non-responsive and shall not be accepted.

- C. It is not the intent of this portion of the specifications to cover concrete, grouting, masonry work, plumbing, electrical work (power and control wiring), utility connections, final cleaning of glazing or counter flashing. This portion of the work shall be the responsibility of the General Contractor or his selected Subcontractors other than the Greenhouse Manufacturer.
- D. No masonry or foundation installation shall be made prior to approval of greenhouse drawings. Approved greenhouse drawings shall be used to make all masonry and foundation installations. Dimensions may vary slightly from contract drawings to accommodate manufacturer's standard, but total area shall not be less than 98% of that shown.
- E. Related Work Specified Elsewhere:
 - 1. Concrete floors, grouting of sills and base plates, and masonry walls: Division 03 and 04.
 - 2. Doors and door hardware: Division 08.
 - 3. Plumbing rough-in work and hook-up of greenhouse plumbing systems, and downspouts described in this section: Division 22.
 - 4. Electrical power wiring, environmental control system wiring, lighting, conduit and hook-ups of greenhouse electrical equipment provided under this section: Division 26.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall have a minimum of 5 years experience in fabrication and erection of glazed structures for similar projects.
- B. Installer Qualifications: Greenhouse installer shall have a minimum of 5 years experience in the erection of glazed structures for similar projects.
- C. Structural Engineer Qualifications: A Structural engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of greenhouse systems that are similar to those indicated for this Project in material, design, and extent.
- D. Engineering Responsibility: Prepare data for greenhouse systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in

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assemblies similar to those indicated for this Project.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Protect materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent damage or deterioration.

1.09 COORDINATION

- A. Pre-Construction Conferences: Coordination meetings are required and should be scheduled in advance of installation of services and features that must be integrated in the greenhouse structures.
 - 1. Coordination meeting is required to locate and coordinate with fire protection, plumbing, electrical and low voltage work above and below grade. Identify all points of entry and support. Provide appropriate details for each service type. Notify the Architect of any conflicts or discrepancies.
 - 2. Coordination is required with structural concrete wall supporting the greenhouse structure. Coordinate location of all doors and other wall openings.
 - 3. Coordination is required with Irrigation work specified in Division 32.

PART 2 PRODUCTS

2.01 GREENHOUSE MANUFACTURER

- A. Basis of Design: Vail, Steel Greenhouse by Nexus Greenhouse Corporation., 10983 Leroy Dr., Northglenn, CO 80233. Tel. (800) 228-9639, ext 536 . Fax. (303)457-2801. Email. bids@nexuscorp.com.
- B. Must be a member, in good standing, of the National Greenhouse Manufacturer's Association (NGMA).

2.02 GREENHOUSE

- A. Components
 - 1. Primary structural members shall be fabricated from square galvanized steel tubing with a minimum 45,000 p.s.i. yield strength. No roll formed sections allowed.
 - 2. Aluminum extrusions used for bars, vents and other secondary framing members shall be 6063-T6 alloy.
 - 3. Roof trusses shall be factory welded using square galvanized tubing. Minimum sizing are 2" square, 15 ga. top chord, 2" square, 15 ga. bottom chord and 1 ½" square, 18 ga. secondary web members. Welds will be re-galvanized with a flame spray process.

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No painting of welded areas.

4. Columns shall be fabricated from minimum 4" square galvanized steel tubing.
5. Truss to column connection will be made with a column cap and gutter saddle assembly made from Tenzaloy, a high strength alloy.
6. Roof purlins shall be fabricated from 2" square 15 ga. galvanized steel tubing as a minimum. The purlins shall have a swaged end for a continuous purlin connection. Purlins shall be bolted to truss top chords. No screw attachments are allowed.
7. Gutters shall be galvanized steel with a baked-on enamel paint on the exterior side as an extra coating. The gutter will be designed for water drainage only. No fixed truss or bow attachments are allowed.
8. Horizontal and vertical framing shall be fabricated from 2" square, 16 ga. tube minimum.
9. Glazing extrusions for structured sheeting shall be made of aluminum and consistent with manufacturer's standard shapes. A two-piece gasketed extrusion shall be used on roof areas and a one-piece extrusion on vertical areas. Extrusions are complete with necessary accessories for greenhouse construction.

2.03 MATERIALS

A. Steel:

1. Square Galvanized Tubing: ASTM A500
2. Sheets: Roll Formed ASTM A36
3. Plates: ASTM A36

B. Aluminum:

1. Extrusions: Alloy 6063-T6 or 6063-HS
2. Sheet: Alloy 3003-H14.
3. Plates: Alloy 6061-T6 or 6063-HS.

C. Fasteners:

1. Bolts: ASTM A307
2. Self Drill Screws: AISI C 1022
3. Self Tapping Cap Screws: AISI C 1018SS

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4. Anchor Bolts: Refer to Division 03.

D. Glazing

1. Glazing panels shall be **self-extinguishing** polycarbonate, achieving a CC-1 classification via ASTM D-635.
 - a. twin wall construction
 - b. 8 mm thick
 - c. clear color
 - d. condensation control on interior surface
 - e. 10 year warranty
2. Panels shall be furnished in continuous sections on each slope of the roof and on sidewall and gable end areas.

E. Glazing System

1. Glazing extrusions for structured sheeting shall be made of aluminum and consistent with Manufacturer's standard shapes.
2. A two piece gasketed aluminum extrusion shall be used on roof areas. Glazing caps shall be gasketed and extend in one piece from the eave to the ridge. One piece, non-gasketed, aluminum extrusions may be used on vertical areas.
3. Extrusions are to be provided and installed complete with necessary accessories for greenhouse construction.

F. Glazing Seals for Polycarbonate Covering:

1. External glazing tape shall be applied to the polycarbonate sheets as recommended by Manufacturer.
2. EPDM rubber gasket of type recommended by Manufacturer shall be installed in the glazing caps.
3. GE silicone sealant or equivalent shall be applied in accordance with Manufacturer's recommendations.

G. Greenhouse Doors and Frames: Refer to Division 8.

H. Insect Screens: Provide aluminum frames with woven aluminum insect screen, 18x16 mesh with brushes at vent rack arm locations.

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2.04 MECHANICAL EQUIPMENT

- A. Vents: Provide sash of size indicated on drawings, designed to open out in a continuous operation from end to end and with a weather tight hinge and weather tight fit between sash and vent header.

West Greenhouses		
H600		
	1EA	Double motorized ridge vent
	2EA	EDDG style sidewall vents
H601		
	1EA	Double motorized ridge vent
	2EA	EDDG style sidewall vents
East Greenhouses		
H500	1EA	Double motorized ridge vent
H501	1EA	Double motorized ridge vent
H502	1EA	Double motorized ridge vent

- B. Vent Motors : Motors to operate each vent indicated on drawings and as recommended by Manufacturer.
- C. Exhaust Fans : Fans will use heavy duty totally enclosed motors and be AMCA approved.

West Greenhouses		
H600		
	1EA	American Coolair AL30K aluminum, slant wall housing, one speed
	1EA	American Coolair AL30K aluminum, slant wall housing, two speed
H601		
	1EA	American Coolair AL30K aluminum, slant wall housing, one speed
	1EA	American Coolair AL30K aluminum, slant wall housing, two speed
East Greenhouses		
H500		
	1EA	American Coolair AL30K aluminum, slant wall housing, one speed
	1EA	American Coolair AL30K aluminum, slant wall

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		housing, two speed
H501		
	1EA	American Coolair AL30K aluminum, slant wall housing, one speed
	1EA	American Coolair AL30K aluminum, slant wall housing, two speed
H502		
	1EA	American Coolair AL30K aluminum, slant wall housing, one speed
	1EA	American Coolair AL30K aluminum, slant wall housing, two speed

- D. Evaporative Pad System: The evaporative pad system will consist of pads made of cross fluted cellulose paper, a distribution pipe with deflectors, a **stainless steel** return system and a sump pump adequate for the systems length.

West Greenhouses		
H600	1EA	4' x 16' American Coolair PVC evaporative pad system with motorized intake shutters
H601	1EA	4' x 16' American Coolair PVC evaporative pad system with motorized intake shutters
East Greenhouses		
H500	1EA	3' x 16' American Coolair PVC evaporative pad system with motorized intake shutters
H501	1EA	3' x 16' American Coolair PVC evaporative pad system with motorized intake shutters
H502	1EA	3' x 16' American Coolair PVC evaporative pad system with motorized intake shutters

- E. Horizontal Airflow Fans : Mechanically operated fans indicated on drawings and as recommended by Manufacturer.

West Greenhouses		
H600	3EA	Schaefer 12" haf fans
H601	3EA	Schaefer 12" haf fans
East Greenhouses		
H500	2EA	Schaefer 12" haf fans
H501	2EA	Schaefer 12" haf fans
H502	2EA	Schaefer 12" haf fans

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F. Heating Systems (If applicable to project requirements):

West Greenhouses		
H600	NONE	
H601	NONE	
East Greenhouses		
H500	2EA	Modine HER 150 Electric Unit Heaters, 208v, 3 phase
H501	2EA	Modine HER 150 Electric Unit Heaters, 208v, 3 phase
H502	2EA	Modine HER 150 Electric Unit Heaters, 208v, 3 phase

- G. Energy/Shade Curtains: A truss to truss, push/pull system using a rack and pinion drive will be used. The curtain will have a slope/flat/slope profile following the roofline and creating an "attic" space above the middle of the house for energy efficiency. The curtain is to be supported by guidewires, not suspension hooks. No wire or cable drives are allowed.

West Greenhouses		
H600	SYSTEM	Motorized shade system with Aluminet 50% ICFR Fire Retardant 4855 shade cloth
H601	SYSTEM	Motorized shade system with Aluminet 50% ICFR Fire Retardant 4855 shade cloth
East Greenhouses		
H500	SYSTEM	Motorized shade system with Aluminet 50% ICFR Fire Retardant 4855 shade cloth
H501	SYSTEM	Motorized shade system with Aluminet 50% ICFR Fire Retardant 4855 shade cloth
H502	SYSTEM	Motorized shade system with Aluminet 50% ICFR Fire Retardant 4855 shade cloth

- H. Environmental Controls/Computers: Wadsworth Control Systems Seed Controller with custom contactor panel, wiring diagram, Seed software, ethernet alarm manager, outdoor weather station, one day on site training.

I. Growth Lights:

West Greenhouses		
H600	NONE	

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H601	NONE	
East Greenhouses		
H500	16EA	PARsource Photobio*T Duo LED lights, 277v, 600w
H501	27EA	PARsource Photobio*T Duo LED lights, 277v, 600w
H502	27EA	PARsource Photobio*T Duo LED lights, 277v, 600w

J. Plant Watering Systems:

West Greenhouses		
H600	SYSTEM	Bench mounted drip irrigation system
H601	SYSTEM	Bench mounted drip irrigation system
East Greenhouses		
H500	SYSTEM	Bench mounted irrigation system and overhead misting system
H501	SYSTEM	Bench mounted irrigation system and overhead misting system
H502	SYSTEM	Bench mounted irrigation system and overhead misting system

K. Bench Systems: Benches as indicated on drawings. Benches will have leg supports made from 1-½" square-galvanized tubing spaced on 6'-0" intervals. The bench tops will consist of extruded aluminum perimeter sides (1" or 3" tall) with 1" square, 18 ga. cross pieces on 2'-0" centers. Covering will be hot dipped ¾", 13 gauge expanded metal.

1. All bench heights: 32".
2. Stationary Benches: Legs and top support rails shall be inset a minimum of 3" on each side and 6" on the ends to facilitate easier movement down aisles.
3. Rolling Benches: Legs and top support rails shall be inset a minimum of 3" on each side and 6" on the ends to facilitate easier movement down aisles. Two runs of 1.315" roller pipe (14 ga.) to allow for top and aisle movement.

West Greenhouses		
H600		
	7EA	6' x 16' rolling top benches
	7EA	20" x 5' stationary top benches
H601		

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	7EA	6' x 16' rolling top benches
	7EA	20" x 5' stationary top benches
East Greenhouses		
H500		
	1EA	6' x 13' stationary top benches
	2EA	6' x 16' stationary top benches
	5EA	33" x 3' stationary top benches
	8EA	33" x 6' stationary top benches
	3EA	16" x 6' stationary top benches
H501		
	4EA	6' x 16' rolling top benches
	2EA	33" x 3' stationary top benches
	2EA	33" x 6' stationary top benches
	3EA	16" x 6' stationary top benches
H502		
	3EA	6' x 16' rolling top benches
	1EA	6' x 13' stationary top benches
	2EA	33" x 3' stationary top benches
	2EA	33" x 6' stationary top benches
	5EA	16" x 6' stationary top benches

2.05 FABRICATION

- A. Fabricate components in accordance with shop drawings. Shop fabricate to greatest extent practical to minimize field cutting, splicing, and assembly.
- B. Welding:
 - 1. Comply with recommendations of American Welding Society.
 - 2. Welds shall be re-galvanized with a flame spray process, no painting of welded areas.
- C. Fabricate components to allow for accurate fit of joints and corners.

PART 3 EXECUTION

3.01 PREPARATION

- A. Examine areas and conditions under which greenhouse work is to be installed. Notify Contractor in writing of conditions detrimental to proper and timely installation of work.
- B. Coordinate and furnish anchorages, setting diagrams, templates and directions for installation of anchorages. Coordinate delivery of such items to project site.

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3.02 ERECTION

- A. Drilling and setting of anchor bolts is to be by Division 03.
- B. Erect greenhouse and related components in accordance with Manufacturer's written instructions and final shop and erection drawings.
- C. Greenhouse Installer is responsible for all unloading of greenhouse materials, systems, equipment and to provide any lift or installation equipment required.
- D. Greenhouse Installer shall have not less than 5 years experience installing work of similar size and scope.

3.03 INSTALLATION OF EQUIPMENT

- A. General: Install equipment in accordance with Manufacturer's installation instructions and recognized industry practices to insure intended function.
- B. Equipment will be installed in place by the Greenhouse Installer.
- C. All mechanical connections (electrical or plumbing) will be performed by electrical, plumbing, or mechanical contractors.

3.04 WARRANTY

- A. Structural: All products manufactured by Greenhouse Manufacturer shall be new and guaranteed free from defects in material and workmanship for one year from customer receipt. (Manufacturer shall submit warranty for approval with bid.)

PART 4 - BID ALTERNATE

4.01 ALTERNATE BID 2

A. Greenhouse H502 - Additive Alternate

1.	Bottom heat at benches
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END OF SECTION

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SECTION 21 13 00 - FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Where items from the referenced Codes and Standards are repeated in this Specification, it is intended to call attention to them. It is not intended that other parts of the referenced Codes and Standards shall be assumed to be omitted if not repeated in this Specification.
- C. Include all labor, material, equipment and service necessary for, and reasonably incidental to the complete coordinated design, fabrication, and installation of the automatic fire sprinkler systems as generally indicated on the Contract Drawings.
- D. It is the intent of these specifications to describe the complete wet pipe sprinkler system. The Contractor is responsible for carefully and critically reviewing the Contract Drawings, specifications, and site conditions to the extent and as far as practicable. Any case of error, omission, discrepancy or lack of clarity shall be promptly identified to the Owner's Representative for clarification.
- E. In general, work shall include, but not be limited to:
 - 1. The detailed and coordinated design, fabrication, procurement, and installation of the complete fire sprinkler systems as generally indicated on the Contract Drawings, and as necessary for compliance with the requirements of the California Division of the State Architect (DSA).
 - 2. Installation of flexible connections and seismic bracing.
 - 3. All penetrations through walls, floors and ceilings necessary for the installation of the fire sprinkler system additions including the installation of approved firestop assemblies necessary to maintain the designed fire resistance rating of the wall, ceiling, or floor assembly.
 - 4. Systems and device testing.
 - 5. All necessary permits and fees.
- F. The fire sprinkler systems protecting the building areas shall be hydraulically designed wet pipe systems for generally Ordinary Hazard occupancies (Exception: offices, restrooms, corridors, and similar spaces shall be designed for a Light Hazard occupancy). Calculations shall be in accordance with NFPA 13 – 2016 requirements and shall include required hose stream allowances.
- G. Greenhouse exposure protection systems shall be deluge, configured for manual activation via the riser-mounted "Emergency Release" or via the electric solenoid valve actuated by the building fire alarm and linear heat detection system. System calculations

shall provide for a minimum discharge of 3 gpm per linear foot of greenhouse ridgeline and a 0.30 gpm per sq ft density over the exposed polycarbonate exterior vertical wall surfaces. Calculations shall include a 100 gpm hose allowance.

- H. Fire sprinkler hydraulic calculations shall include a minimum 10% "safety margin" (i.e. calculated fire sprinkler pressure demand shall not exceed 90% of the available supply pressure).
- I. Pipe sizes indicated on the Drawings shall not be reduced.
- J. Above-ceiling interstitial spaces are combustible. Fire sprinkler protection is required.
- K. The Contractor shall be responsible for establishing and implementing all safety programs and procedures for this project and shall comply with all Federal, State and Local Safety and Health Regulations.

1.02 RELATED SECTIONS

- A. General Requirements
- B. Site Work
- C. Fire Stop Systems
- D. Fire Alarm Systems

1.03 DRAWINGS

- A. The Contract Drawings are diagrammatic only. Pipe lengths shown are approximate center-to-center lengths between fittings. Contractor shall determine the actual measurements and make any and all such length and offset adjustments as may be necessary to complete the installation at no change in the contract price. The Drawings are not intended to relieve the Contractor of any responsibility for avoiding conflicts or obstructions, or for installing the number of sprinklers and supply piping as required to provide complete protection of the designated areas in accordance with the requirements of the referenced standards and these specifications. Written approval shall be obtained from the Owner's Representative prior to making any major deviations from the arrangement and layout shown on the Drawings.

1.04 QUALITY ASSURANCE

- A. Equipment: All equipment shall be new, and Listed by Underwriters' Laboratories or Approved by Factory Mutual.
- B. Contractor Qualification: The Contractor shall California licensed C-16 Fire Protection Contractor experienced in the installation of similar automatic fire protection systems.

1.05 REFERENCES

- A. General: System, equipment, installation, and materials and methods used shall comply with the following standards:
1. The requirements of the State of California, and the California Division of the State Architect (DSA).
 2. Applicable requirements of the City of Oakland, California.
 3. National Fire Protection Association (NFPA) 13, *Standard for the Installation of Sprinkler Systems* 2016 Edition, with California Amendments.
 4. California Building and Fire Codes.
 5. Manufacturer's recommendations and guidelines.

1.06 SUBMITTALS

- A. Submit the following in accordance with the General requirements:
1. Working Plans as described in NFPA 13, shall be submitted within 30 days after the award of the contract. Installation shall not begin until approval has been received. Upon request, electronic files of the Contract Drawings will be provided for the Contractor's use in developing their coordinated, detailed shop drawings for this project. All drawings prepared by the Contractor shall be developed using CAD computer-aided drafting (AutoCAD or compatible). Installation shall not begin until approval has been received.
 2. Shop Drawings: Submit seven prints of each shop drawing. Minimum allowable sheet size is 8-1/2 x 11-in.
 3. Product Data: Within 15 days after the award of the contract, submit for approval seven copies of manufacturer's literature, wiring diagrams, etc., for each piece of equipment used in the system. If the manufacturer's catalog sheets show more than one item, the items proposed for use shall be identified.
 4. Record Drawings: Corrected and approved Working Plans shall be submitted in reproducible format (Xerox velum or approved equal) to the Owner's Representative prior to final acceptance of the installation. Submit all drawing electronic files developed for this Project. The shop drawings shall be revised to show the "as-built" conditions including actual locations of all system components and affected equipment including piping, sprinkler heads, risers, laterals, supports, and points of connection. The Record Drawing files shall be submitted in AutoCAD (2010 format).
 5. Operation and Maintenance Manuals: Prior to final acceptance of the installation, submit for approval 6 sets of labeled, bound and indexed Operation and Maintenance Manuals indicating complete maintenance and operating procedures on all specialty items. Each O & M Manual shall include a copy of the California Edition of NFPA 25 *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, and copies of completed Contractor's Material & Test Certificate(s).

PART 2 - PRODUCTS

2.01 GENERAL

- A. All materials and equipment furnished by the Contractor shall be new, first grade standard, current products of a manufacturer regularly engaged in the production of such materials and equipment. Where two or more pieces of equipment performing the same function are required, they shall be the product of one manufacturer and exact duplicates.

2.02 PIPING, FITTINGS, AND SPECIALTIES

- A. Piping shall be new, designed for 175 PSI working pressure, conforming to ASTM specifications, and have the manufacturer's name or brand along with the pipe applicable ASTM standard marked on each length of pipe.
- B. All piping shall be Schedule 40 black steel pipe. Pipe shall be manufactured in accordance with specifications ASTM A 135 and A 53. Thin-walled piping materials (such as Schedule 5, 7, 10 and threadable thinwalls, etc.) will not be permitted.
- C. All fire protection system piping shall be provided with factory applied antimicrobial coatings to inhibit Microbiologically Influenced Corrosion (MIC).
- D. Schedule 40 black steel pipe shall be joined by screwed joints in accordance with specification ANSI B 1.20.1 - 1983 (ANSI/ASME B 2.1), by welded joints in accordance with specification ANSI/ASME B 31.1, Chap. 5, or by UL - listed mechanical grooved couplings. Grooves may be rolled or cut and they shall be dimensionally compatible with the couplings.
- E. Sprinkler piping, fittings, hangers and appurtenances exposed to weather, used in a corrosive atmosphere, or as noted on drawings shall be galvanized.
 - 1. All wet-pipe (interior) fire sprinkler piping, fittings, hangers, and appurtenances for the Greenhouse structures shall be galvanized.
 - 2. All deluge (exposure protection system) piping, fittings, hangers, and appurtenances for the Greenhouse structures shall be galvanized.
 - 3. All wet-pipe fire sprinkler piping, fittings, hangers, and appurtenances for the Soil Bin structure shall be galvanized.
 - 4. All fire protection drain and drain riser piping and fittings shall be galvanized, and installed pitched to drain (minimum 1/2" per 10 foot length).
- F. Threaded fittings shall be Class 125 cast iron, black, and in accordance with ANSI B 16.4, or ductile or malleable iron, 150 lb. class, black, and in accordance with ANSI B 16.3. Screwed joints shall be made up with approved Teflon joint compound or tape.
- G. Flanged fittings shall be cast iron, short body, Class 125, black, and in accordance with ANSI B 16.1. Gaskets shall be full-face of 1/8-in. minimum thickness red sheet rubber. Flange bolts shall be hexagon head machine bolts with heavy semi-finished hexagon head nuts, cadmium plated, having dimensions in accordance with ANSI B 18.2.

- H. Welded fittings shall be steel, standard weights, black, and in accordance with ANSI B 16.9, ANSI B 16.25, ASTM A 234, ANSI B 16.5, and ANSI B 16.11.
- I. Grooved couplings and mechanical fittings shall be UL listed or FM approved for fire protection service. Plain-end type pipe fittings and couplings shall not be used. Snap-On and Strapless Outlet fittings shall not be permitted.
 - 1. Flexible couplings shall be used to connect pipe to grooved elbow and tee fittings.
 - 2. Rigid couplings shall be used to connect straight runs of pipe, only.
 - 3. Flexible couplings are permitted to connect straight runs of pipe where the pipe penetrates a wall, floor, or beam where sufficient annular clearance is not provided.
 - 4. Flexible and rigid couplings shall be of the same manufacturer as the fittings to which they are connected.
- J. Pendent sprinklers in suspended finished ceilings shall be connected utilizing UL-Listed fire sprinkler flexible hose assemblies, Victaulic Series AH2 or approved equal. Flexible hose assemblies shall not exceed 41.1 equivalent feet for a 6-foot hose length with 4 bends and elbow bracket (in accordance with the UL Listing).
- K. In-Building Risers shall be installed as indicated on the plans. Risers shall be composed of a single extended 90 degree fitting of fabricated 304 stainless steel tubing, maximum working pressure 200 psi. The fitting shall have a grooved-end connection on the outlet (building) side and a CIPS coupler on the inlet (underground) side. The In-Building Riser shall be an Ames Fire & Waterworks Series IBR (or approved equal).
- L. All sprinkler pipe passing through or crossing building seismic joints, shall contain a flexible expansion loop, designed for seismic movement. Flexible loops shall impart no thrust loads to building structure. Loops shall be located at, or near, the building seismic joint. Seismic bracing shall not pass through building seismic joint and shall not connect or tie together different sides or parts of building structure. Flexible loops shall be capable of a minimum of 8-inches of movement in the $\pm X$, $\pm Y$, $\pm Z$ planes. Flexible seismic loops to be Fireloop as manufactured by The Metraflex Company, Chicago, IL (no known equal).

2.03 VALVES

- A. Main system control valves shall be of the indicating gate or butterfly type with supervisory switch.
- B. Check valves shall be swing type, with removable faceplate, and shall have rubber or composition discs. Check valves shall not be installed in the vertically-downward position unless specifically approved for this position.
- C. Deluge valves shall be the flow control type, capable of being externally reset. Viking Model J-1 or approved equal.
- D. All drain valves and test valves shall have replaceable rubber or composition discs.

- E. Automatic air release valve assemblies shall be Potter PAAR-B (or approved equal) with isolation valve, mesh strainer assembly, water retention pan, and appurtenances.

2.04 **SPRINKLERS AND NOZZLES**

- A. Sprinklers in unfinished areas shall be Quick Response upright, pendent or sidewall, ½" orifice, k=5.6, 200°F rated (or as required by NFPA 13 Section 8.3.2), chrome finish, Viking Microfast (VK300, VK302) or approved equal.
- B. Pendent sprinklers in finished ceiling areas shall be Quick Response recessed pendent sprinklers, 155°F (or as required by NFPA 13 Section 8.3.2), ½" orifice, k=5.6, white polyester finish. Viking Microfast Model VK302 with thread-on type recessed escutcheon (white finish), Viking Model E-2 or approved equal.
 - 1. Exception: Pendent sprinklers in ceilings with surface-mounted light fixtures and similar obstructions may be protected utilizing white pendent sprinklers with matching 2-piece pendent (#401) escutcheons.
- C. Greenhouse exposure protection deluge system sprinklers and nozzles shall be;
 - 1. Roof ridge sprinklers shall be upright, 17/32" orifice, k=8.0, brass finish, Viking Model VK350 or approved equal, with operating elements removed.
 - 2. Wall exposure protection nozzles shall be Viking Model C-1, ½" NPT, k=3.0, with nozzles oriented parallel to roof.
- D. All sprinklers subject to mechanical damage, or installed less than 7 feet above finished floor shall be provided with UL listed sprinkler guards. Sprinkler Guards shall be SprinkGuard™ ThreadGuard™ (Part #201686) with white finish.
- E. Extra sprinklers in the quantities required by NFPA 13 (with a minimum of 6 spare sprinklers of each type provided on the Project) shall be provided in suitable metal cabinet(s), along with one sprinkler wrench appropriate for each type of sprinkler installed. The metal cabinet(s) shall be permanently mounted adjacent to the fire sprinkler riser assembly.

2.05 **FIRE ALARM AND RELATED EQUIPMENT**

- A. Waterflow switches shall have (2) SPDT contacts. They shall be installed and adjusted under this Section.
- B. Valve supervisory switches shall have (2) SPDT contacts. They shall be installed and adjusted under this Section.
- C. Exterior audible alarm (as required by the California Building Code) shall be a Potter Electric "SASH-120" or approved equal. Provide electrical connections and service as indicated on the "Wiring Schematic" provided in the Contract Drawings.

PART 3 - EXECUTION

3.01 GENERAL

- A. Supply for the fire protection systems shall be connected only to underground laterals tested and flushed in accordance with NFPA 24.
- B. Ream all piping to remove all burrs. Pipe sections shall be cleaned inside to remove all chips and foreign materials prior to making joints.
- C. Install hangers, flexible connections, swing joints, and seismic bracing in accordance with NFPA 13.
- D. Seismic brace load calculations shall be in strict accordance with the 2016 Edition of NFPA 13.
- E. System piping shall be installed such that no joints, fittings or devices occur directly over electrical equipment. Fire sprinkler piping shall not be installed in Dedicated Electrical Spaces as defined in the California Electrical Code.
- F. Install combination inspector's test and system drain valves at the locations indicated on the Drawings. Discharge shall be piped as indicated.
- G. Install control valves in the locations shown on the Drawings. Where valves controlling sprinkler systems are inaccessible or at an elevation of 7 ft. or greater above the finished floor, provide and install permanent ladders, clamped treads on risers, chain operators or similar devices to provide access to authorized persons during emergencies. Valves located above finished ceiling shall be provided with labeled access doors.
- H. Install permanent valve identification signs and hydraulic nameplate data as required by NFPA 13. Signs shall be attached by chain or other durable means. Ink or felt-tipped pens shall not be used on hydraulic nameplates or signs. All markings shall be permanent.

3.02 PRODUCT HANDLING

- A. Deliver materials and store on site in original containers with seals unbroken and labels intact until time of use, in accordance with the manufacturer's instructions.
- B. All materials and equipment shall be carefully handled at all times. Only suitable and proper equipment and appliance shall be used for the safe loading, hauling, unloading, handling, and installation of material.
- C. All sprinklers shall be protected during installation with the protective cover provided by the manufacturer. The protective cover shall not be removed until all construction which creates a potential for damage to the sprinkler is completed, including but not limited to mechanical equipment and duct, electrical equipment and conduit, plumbing equipment and piping, wall and ceiling construction, etc.

3.03 **JOB CONDITIONS**

- A. Other trades will be working in the building during the contract period. Coordinate work schedule, material deliveries etc. with the Owner's Representative.
- B. Impairments of existing fire protection systems shall be minimized, coordinated with the Owner's Representative, and performed in accordance with NFPA 25 (California Edition). All existing fire protection systems shall be restored to service at the end of each working day.
- C. All equipment and material to be furnished and installed on the Project shall be coordinated with space constraints. All equipment and material shall be fabricated such that complete systems may be broken down into sections suitable for lifting and fitting through passageways without modification to the building unless otherwise noted.

3.04 **PENETRATIONS**

- A. The Contractor shall be responsible for all openings and penetrations.
- B. Cutting structural members for passing of piping or pipe hanger fastenings will not be permitted except with approval of the Project Structural Engineer. Penetrations of ventilation ducts and similar equipment for the through-passage of piping shall not be permitted.
- C. Suitable means shall be provided at each hole or penetration to maintain the designed fire resistance rating of the wall, ceiling or floor assembly.
- D. Install split wall plates or escutcheons where exposed piping passes through a finished floor, wall or ceiling. They shall fit snugly around piping. The finish of escutcheons or wall plates shall match the color of adjacent walls, ceilings or floors.

3.05 **PAINTING**

- A. All exposed piping, conduit, valves etc. will be provided by other Divisions of this project. Clean all exposed surfaces of oil, dirt, etc. to the Owners Representative's satisfaction.
- B. Remove protective bags and wrappings after painting is completed. All sprinklers, which have any paint on them, shall be replaced. Cleaning of painted sprinklers is not permitted.

3.06 **FIELD QUALITY CONTROL**

- A. Upon completion of installation and while piping is still exposed, hydrostatically test the systems at 200 psi (or 50 psi in excess of the system working pressure, whichever is greater) for a period of 2 hours. Any drop in pressure or any leak shall be cause to fail the test and a new test shall be scheduled once repairs are made. A minimum of seventy-two hours notice shall be given to the Project Manager and the Authorities Having Jurisdiction prior to any inspection. The contractor shall have all equipment necessary for the inspection available to the Authorities Having Jurisdiction, including a ladder of an appropriate height.

- B. A pre-installation inspection of pipe, fittings, and devices is required.
- C. The Contractor shall be responsible for all leaks in new and existing piping.

3.07 **GUARANTEE**

- A. Except as otherwise expressly provided in the Contract Documents, and excepting only items of routine maintenance, ordinary wear and tear and unusual abuse or neglect, Contractor guarantees all work executed by him and all supplies, materials and devices of whatsoever nature incorporated in, or attached to the work, or otherwise delivered to the Owner's Representative as part of the work pursuant to the Contract, to be absolutely free of all defects of workmanship and materials for a period of one year after final acceptance of the entire work by the Owner's Representative.

END OF SECTION

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SECTION 22 05 16 - FLEXIBLE FITTINGS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible pipe connectors.

1.02 RELATED REQUIREMENTS

- A. Section 22 10 05 - Plumbing Piping.
- B. Section 23 23 00 - Refrigerant Piping.

1.03 SUBMITTALS

- A. See , for submittal procedures.
- B. Product Data:
 - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot (meter) and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com.
 - 2. The Metraflex Company: www.metraflex.com.
 - 3. Substitutions: See Section 01 66 00 - Product Delivery, Storage and Handling.
- B. Inner Hose: Bronze or Stainless Steel.
- C. Exterior Sleeve: Braided bronze or Stainless Steel.
- D. Pressure Rating: 125 psi and 450 degrees F (862 kPa and 232 degrees C).
- E. Joint: As specified for pipe joints.
- F. Size: Use pipe sized units.
- G. Maximum offset: 3/4 inch (20 mm) on each side of installed center line.
- H. Application: Copper piping.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.
- C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- D. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

END OF SECTION

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**SECTION 22 05 17 -
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe sleeves.
- B. Manufactured sleeve-seal systems.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this section.

1.03 REFERENCE STANDARDS

- A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2016.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified this section.
 - 1. Minimum three years experience.
 - 2. Approved by manufacturer.
- C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

1.07 WARRANTY

- A. See Division 1, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

- A. Manufacturers:
 - 1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com.
 - 2. Jay R. Mfg. Co..
 - 3. Zurn Plumbing Products Group..
- B. Vertical Piping:
 - 1. Sleeve Length: 1 inch (25 mm) above finished floor.
 - 2. Provide sealant for watertight joint.
 - 3. Blocked Out Floor Openings: Provide 1-1/2 inch (40 mm) angle set in silicon adhesive around opening.

4. Drilled Penetrations: Provide 1-1/2 inch (40 mm) angle ring or square set in silicone adhesive around penetration.
- C. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- D. Pipe Passing Through Below Grade Exterior Walls:
 1. Zinc coated or cast iron pipe.
 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- E. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 2. Connect sleeve with floor plate except in mechanical rooms.
- F. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 2. Connect sleeve with floor plate except in mechanical rooms.
- G. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.
- H. Clearances:
 1. Provide allowance for insulated piping.
 2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch (25 mm) greater than external; pipe diameter.
 3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

2.02 MANUFACTURED SLEEVE-SEAL SYSTEMS

- A. Manufacturers:
 1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com.
 2. Flexicraft Industries; PipeSeal: www.flexicraft.com.
 3. Jay R. Mfg. Co..
 4. Zurn Plumbing Products .
- B. Modular/Mechanical Seal:
 1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
 2. Provide watertight seal between pipe and wall/casing opening.
 3. Elastomer element size and material in accordance with manufacturer's recommendations.
 4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.
- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Inserts:

1. Provide inserts for placement in concrete formwork except where structural engineer has specifically approved location and method for drilled through openings.
- E. Structural Considerations:
 1. Do not penetrate building structural members unless indicated.
 2. All sleeves not already shown approved in structural drawing details shall be submitted to and approved by the structural engineer prior to fabrication..
- F. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
 1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
 2. Aboveground Piping:
 - a. Pack solid using mineral fiber complying with ASTM C592.
 - b. Fill space with an elastomer caulk to a depth of 0.50 inch (15 mm) where penetrations occur between conditioned and unconditioned spaces.
 3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.
 4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.
- G. Manufactured Sleeve-Seal Systems:
 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 3. Locate piping in center of sleeve or penetration.
 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 5. Tighten bolting for a water-tight seal.
 6. Install in accordance with manufacturer's recommendations.
- H. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.
- C. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

END OF SECTION

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**SECTION 22 05 19 -
METERS AND GAUGES FOR PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flow meters.
- B. Pressure gauges and pressure gauge taps.
- C. Thermometers and thermometer wells.

1.02 RELATED REQUIREMENTS

- A. Section 23 90 00 Energy Management and Control System
- B. Section 22 10 05 Plumbing Piping

1.03 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments 2013.
- B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers 2014.
- C. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance 2012, with Addendum (2018).
- D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.
- C. Project Record Documents: Record actual locations of components and instrumentation.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 66 00 - Product Delivery, Storage and Handling. for additional provisions.

1.05 FIELD CONDITIONS

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 ULTRAMAGNETIC WATER METERS

- A. Manufacturers:
 - 1. Onicon; www.onicon.com.
 - 2. Badger Meters; www.badgermeter.com.
 - 3. Substitutions: See Section 01 66 00 - Product Delivery, Storage and Handling Division 1 for additional submittal requirements.
- B. Design - Sensing Technology: Ultrasonic flow sensing element shall utilize matched direct path, wetted ultrasonic transducers and 1000 OHM Platinum RTD.
- C. Construction: Flowmeter shall consist of a drop forged corrosion resistant metal flow body with process connections, integral transducers and a processor / transmitter. All wetted materials shall be NSF 372 compliant.
- D. Maximum Pressure Rating: 400psi
- E. Maximum Temperature Rating: 250F
- F. Mounting Connections: For NPS ½" – 2", piping connections shall be male NPT threads; for NPS 2 ½" provide ANSI class flange, rated for maximum system temperature and pressure.

- G. Flow Range: Flow-measuring element and transmitter shall cover operating range of equipment or system served.
- H. Accuracy: Flowmeter shall provide calibrated outputs directly from the transmitter, throughout the operating range with the accuracy stated as follows:
 - 1. Plus or minus 1.0% of flow rate over a 25:1 turndown
 - 2. Plus or minus 2.0% of flow rate over a 100:1 turndown
- I. Transmitter: Transmitter shall provide instantaneous flow rate information over a 4-20mA scale and a pulse output for totalized flow information.
- J. Optional Transmitter with Integral Display and Operator Interface: Provide an operator interface consisting of three push-buttons. Display shall visually indicate total fluid volume, instantaneous flow rate and fluid temperature. Output signals shall be either serial network protocol, pulse output, analog output or combination. Pulse output for totalization of flow, Gallons typical. Optional serial communications output shall be native to the BTU meter, BACnet meters shall be BTL certified, secondary communication gateways shall not be permitted. Information provided via the serial communication network shall include: Flow rate, flow total, fluid temperature and a trend including peak values. Meters with serial communications shall be able to provide up to three additional auxiliary pulses configured as inputs or outputs.

2.02 PRESSURE GAUGES

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com.
 - 2. Moeller Instrument Company, Inc: www.moellerinstrument.com.
 - 3. Omega Engineering, Inc: www.omega.com.
 - 4. Substitutions: See Section 01 66 00 - Product Delivery, Storage and Handling.
- B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, liquid filled, with front recalibration adjustment, black scale on white background.
 - 1. Case: Steel with brass bourdon tube.
 - 2. Size: 4-1/2 inch (115 mm) diameter.
 - 3. Mid-Scale Accuracy: One percent.
 - 4. Scale: Psi and kPa.

2.03 PRESSURE GAUGE TAPPINGS

- A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi (1034 kPa).

2.04 DIAL THERMOMETERS

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com.
 - 2. Omega Engineering, Inc: www.omega.com.
 - 3. Weksler Glass Thermometer Corp: www.wekslerglass.com.
 - 4. Substitutions: See Section 01 66 00 - Product Delivery, Storage and Handling.
- B. Thermometers - Adjustable Angle: Dial type bimetallic actuated; ASTM E1; stainless steel case, adjustable angle with front recalibration, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.
 - 1. Size: 3 inch (75 mm) diameter dial.
 - 2. Accuracy: 1 percent.
 - 3. Calibration: Degrees F.
 - 4. Application: NSF labeled or approved for potable water systems.

2.05 TEST PLUGS

- A. Test Plug: 1/4 inch (6 mm) or 1/2 inch (13 mm) brass fitting and cap for receiving 1/8 inch (3 mm) outside diameter pressure or temperature probe with neoprene core for temperatures

up to 200 degrees F (93 degrees C).

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install flowmeters in accessible locations in piping systems based on manufacturer's recommendations regarding orientation and straight run requirements.
- C. Install flowmeter elements with at least the minimum straight lengths of pipe, upstream and downstream from meter, required to produce the published flowmeter accuracy according to manufacturer's written instructions.
- D. Install flow meters with full isolating valves on inlet and outlet to AWWA M6.
- E. Install gauges and thermometers in locations where they are easily read from normal operating level.
- F. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- G. Locate test plugs adjacent thermometers and thermometer sockets.

3.02 COMMISSIONING

- A. After installation, commission all meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gages to proper angle for best visibility. Refer to manufacturers written instructions.

END OF SECTION

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**SECTION 22 05 23-
GENERAL-DUTY VALVES FOR PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Applications.
- B. Ball valves.
- C. Butterfly valves.
- D. Check valves.
- E. Gate valves.
- F. Globe valves.

1.02 RELATED REQUIREMENTS

- A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- B. Section 22 10 05 - Plumbing Piping.

1.03 ABBREVIATIONS AND ACRONYMS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Non-rising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.
- H. WOG: Water, oil, and gas.

1.04 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch) 2013 (Reaffirmed 2018).
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2020.
- C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard 2020.
- D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves 2017.
- E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
- F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End 2020.
- G. ASME B31.9 - Building Services Piping 2020.
- H. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.
- I. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2019).
- J. ASTM A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2019)e1.
- K. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.
- L. AWWA C606 - Grooved and Shouldered Joints 2015.
- M. MSS SP-45 - Bypass and Drain Connections 2003 (Reaffirmed 2008).
- N. MSS SP-67 - Butterfly Valves 2017.
- O. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends 2011.

- P. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends 2018.
- Q. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service 2010a.
- R. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves 2013.
- S. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010.
- T. MSS SP-125 - Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves 2018.
- U. NSF 61 - Drinking Water System Components - Health Effects 2020.
- V. NSF 372 - Drinking Water System Components - Lead Content 2020.

1.05 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.06 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Obtain valves for each valve type from single manufacturer.
 - 2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
 - 2. Protect valve parts exposed to piped medium against rust and corrosion.
 - 3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
 - 4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
 - 5. Secure check valves in either the closed position or open position.
 - 6. Adjust butterfly valves to closed or partially closed position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection and protect flanges and specialties from dirt.
 - a. Provide temporary inlet and outlet caps.
 - b. Maintain caps in place until installation.
 - 2. Store valves in shipping containers and maintain in place until installation.
 - a. Store valves indoors in dry environment.
 - b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. See drawings for specific valve locations.
- B. Provide the following valves for the applications if not indicated on drawings:
 - 1. Shutoff: Ball, butterfly, gate or plug.
 - 2. Swing Check (Pump Outlet):
 - a. 2 NPS (50 DN) and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
 - b. 2-1/2 NPS (65 DN) and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.
 - c. 2-1/2 NPS (65 DN) and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

- C. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.
- D. Required Valve End Connections for Non-Wafer Types:
 - 1. Copper Tube:
 - a. 2 NPS (50 DN) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - b. 2-1/2 NPS (65 DN) to 4 NPS (100 DN): Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
- E. Domestic, Hot and Cold Water Valves:
 - 1. 2 NPS (50 DN) and Smaller:
 - a. Bronze and Brass: Provide with solder-joint or threaded ends.
 - b. Bronze Angle: Class 125, bronze disc.
 - c. Ball: One piece, full port, brass or bronze with brass trim.
 - d. Bronze Swing Check: Class 125, bronze disc.
 - e. Bronze Gate: Class 125, NRS.
 - f. Bronze Globe: Class 125, bronze disc.
 - 2. 2-1/2 NPS (65 DN) and Larger:
 - a. Iron, 2-1/2 NPS (65 DN) to 4 NPS (100 DN): Provide with threaded ends.
 - b. Iron Ball: Class 150.
 - c. Iron Single-Flange Butterfly: 200 CWP, EPDM seat, aluminum-bronze disc.
 - d. Iron Grooved-End Butterfly: 175 CWP.
 - e. Iron Swing Check: Class 125, metal seats.
 - f. Iron Swing Check with Closure Control: Class 125, lever and spring.
 - g. Iron Grooved-End Swing Check: 300 CWP.
 - h. Iron Center-Guided Check: Class 125, compact-wafer, metal seat.
 - i. Iron Plate-Type Check: Class 125; single plate; metal seat.
 - j. Iron Gate: Class 125, NRS.
 - k. Iron Globe: Class 125.

2.02 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
- D. Valves in Insulated Piping: With 2 NPS (50 DN) stem extensions and the following features:
 - 1. Gate Valves: Rising stem.
 - 2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 3. Butterfly Valves: Extended neck.
 - 4. Memory Stops: Fully adjustable after insulation is installed.
- E. Valve-End Connections:
 - 1. Threaded End Valves: ASME B1.20.1.
 - 2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
 - 3. Pipe Flanges and Flanged Fittings 1/2 NPS (15 DN) through 24 NPS (600 DN): ASME B16.5.
 - 4. Solder Joint Connections: ASME B16.18.
 - 5. Grooved End Connections: AWWA C606.
- F. General ASME Compliance:
 - 1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
 - 2. Solder-joint Connections: ASME B16.18.

3. Building Services Piping Valves: ASME B31.9.
- G. Potable Water Use:
 1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
 2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.
- H. Valve Bypass and Drain Connections: MSS SP-45.
- I. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRONZE, BALL VALVES

- A. General:
 1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. One Piece, Reduced Port with Bronze Trim:
 1. Comply with MSS SP-110.
 2. SWP Rating: 400 psig (2760 kPa).
 3. CWP Rating: 600 psig (4140 kPa).
 4. Body: Bronze.
 5. Ends: Press.
 6. Seats: PTFE or TFE.
 7. Stem: Bronze.
 8. Ball: Chrome plated brass.
 9. Manufacturers:
 - a. Viega LLC: www.viega.us.
- C. Two Piece, Standard Port and Full Port with Bronze Trim:
 1. Comply with MSS SP-110.
 2. SWP Rating: 150 psig (1035 kPa).
 3. CWP Rating: 600 psig (4140 kPa).
 4. Body: Forged bronze or dezincified-brass alloy.
 5. Ends: Threaded.
 6. Seats: PTFE or TFE.
 7. Stem: Bronze.
 8. Ball: Chrome plated brass.
 9. Manufacturers:
 - a. Apollo Valves: www.apollovalves.com.
 - b. Viega LLC: www.viega.us.
- D. Three Piece, Full Port with Stainless Steel Trim:
 1. Comply with MSS SP-110.
 2. SWP Rating: 150 psig (1035 kPa).
 3. CWP Rating: 600 psig (4140 kPa).
 4. Body: Bronze.
 5. Ends: Threaded or press.
 6. Seats: PTFE or TFE.
 7. Stem: Stainless steel.
 8. Ball: Stainless steel, vented.
 9. Manufacturers:
 - a. Apollo Valves: www.apollovalves.com.
 - b. Viega LLC: www.viega.us.

2.04 IRON, BALL VALVES

- A. Not needed, not Lead Free.
 1. Comply with MSS SP-72.
 2. CWP Rating: 200 psig (1380 kPa).

3. Body: ASTM A536 Grade 65-45-12, ductile iron.
4. Ends: Flanged.
5. Seats: PTFE or TFE.
6. Operator: Lever, with locking handle.

2.05 IRON, SINGLE FLANGE BUTTERFLY VALVES

- A. Lug Style: Bi-directional dead-end service without use of downstream flange.
 1. Comply with MSS SP-67, Type I.
 2. CWP Rating: 200 psig (1380 kPa).
 3. Body: ASTM A126, cast iron or ASTM A536, ductile iron.
 4. Stem: One or two-piece stainless steel.
 5. Seat: EPDM.
 6. Disc: Stainless steel.

2.06 IRON, GROOVED-END BUTTERFLY VALVES

- A. CWP Rating: 175 psig (1200 kPa).
 1. Comply with MSS SP-67, Type I.
 2. Body: Coated ductile iron.
 3. Stem: Two-piece stainless steel.
 4. Disc: Coated ductile iron.
 5. Disc Seal: EPDM.

2.07 BRONZE, SWING CHECK VALVES

- A. General:
 1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Class 125: CWP Rating: 200 psig (1380 kPa).
 1. Comply with MSS SP-80, Type 3.
 2. Design: Y-pattern, horizontal or vertical flow.
 3. Body: Bronze, ASTM B62.
 4. Ends: Threaded.
 5. Disc: Bronze.
 6. Manufacturers:
 - a. Apollo Valves: www.apollovalves.com.

2.08 IRON, HORIZONTAL SWING CHECK VALVES

- A. Class 125:
 1. Comply with MSS SP-71, Type I.
 2. CWP Rating: 200 psig (1380 kPa).
 3. Design: Clear or full waterway.
 4. Body: ASTM A126, gray cast iron with bolted bonnet.
 5. Ends: Flanged.
 6. Trim: Composition.
 7. Seat Ring and Disc Holder: Bronze.
 8. Disc: PTFE or TFE.
 9. Gasket: Asbestos free.
 10. Manufacturers:
 - a. Apollo Valves: www.apollovalves.com.
 - b. Ferguson Enterprises Inc: www.fnw.com.
 - c. Flomatic Valves; Flo-Flex Swing Check Valve: www.flomatic.com.
- B. Class 250:
 1. Comply with MSS SP-71, Type I.
 2. CWP Rating: 500 psig (3450 kPa).
 3. Design: Clear or full waterway.

4. Body: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged as indicated.
6. Trim: Bronze.
7. Metal Seat.
8. Gasket: Asbestos free.

2.09 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

- A. Class 125 with Lever and Spring-Closure Control.
 1. Comply with MSS SP-71, Type I.
 2. Description:
 - a. CWP Rating: 200 psig (1380 kPa).
 - b. Design: Clear or full waterway.
 - c. Body: ASTM A126, gray iron with bolted bonnet.
 - d. Ends: Flanged as indicated.
 - e. Trim: Bronze.
 - f. Gasket: Asbestos free.
 - g. Closer Control: Factory installed, exterior lever, and weight.
 3. Manufacturers:
 - a. Apollo Valves: www.apollovalves.com.
 - b. Flomatic Valves; 90LS/92LS Swing Check Valve: www.flomatic.com.

2.10 IRON, GROOVED-END SWING CHECK VALVES

- A. 300 CWP:
 1. CWP Rating: 300 psig (2070 kPa).
 2. Body: ASTM A536, Grade 65-45-12 ductile iron.
 3. Seal: EPDM
 4. Disc: Ductile iron.
 5. Coating: Black, non-lead paint.
 6. Manufacturers:
 - a. NIBCO Inc.

2.11 IRON, CENTER-GUIDED CHECK VALVES

- A. Class 125, Compact-Wafer:
 1. Comply with MSS SP-125.
 2. CWP Rating: 200 psig (1380 kPa).
 3. Body: ASTM A126 gray iron.
 4. Body: 316 stainless steel.
 5. Metal Seat: Unleaded bronze.
 6. Metal Seat: Stainless steel.
 7. Resilient Seat: EPDM.
 8. Manufacturers:
 - a. Apollo Valves: www.apollovalves.com.
 - b. Flomatic Valves; 888S6R Wafer Check Valve: www.flomatic.com.
- B. Class 125, Globe:
 1. Comply with MSS SP-125.
 2. CWP Rating: 200 psig (1380 kPa).
 3. Body: ASTM A126 gray iron.
 4. Body: Stainless steel.
 5. Style: Spring loaded.
 6. Ends: Flanged.
 7. Metal Seat: Unleaded bronze.
 8. Metal Seat: Stainless steel.
 9. Resilient Seat: EPDM.

10. Manufacturers:
 - a. Flomatic Valves; 402S6R Globe Check Valve: www.flomatic.com.

2.12 BRONZE, GATE VALVES

- A. General:
 1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Rising Stem (RS) or NRS:
 1. Comply with MSS SP-80, Type I.
 2. Class 125: CWP Rating: 200 psig: (1380 kPa).
 3. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
 4. Ends: Threaded or solder joint joint.
 5. Stem: Bronze.
 6. Disc: Solid wedge; bronze.
 7. Packing: Asbestos free.
 8. Handwheel: Malleable iron, bronze, or aluminum.
 9. Manufacturers:
 - a. Apollo Valves: www.apollovalves.com.
 - b. Ferguson Enterprises Inc: www.fnw.com.

2.13 IRON, GATE VALVES

- A. OS & Y or NRS:
 1. Comply with MSS SP-70, Type I.
 2. Class 125: CWP Rating: 200 psig: (1380 kPa).
 3. Body: ASTM A126, gray iron with bolted bonnet.
 4. Ends: Flanged.
 5. Trim: Bronze.
 6. Disc: Solid wedge.
 7. Packing and Gasket: Asbestos free.
 8. Manufacturers:
 - a. Apollo Valves: www.apollovalves.com.
 - b. Ferguson Enterprises Inc: www.fnw.com.

2.14 BRONZE, GLOBE VALVES

- A. General:
 1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

- C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- D. Install check valves where necessary to maintain direction of flow as follows:
 - 1. Lift Check: Install with stem plumb and vertical.
 - 2. Swing Check: Install horizontal maintaining hinge pin level.
 - 3. Orient plate-type and center-guided into horizontal or vertical position, between flanges.
- E. Provide chainwheels on operators for valves 4 NPS (100 DN) and larger where located 96 NPS (2400 DN) or more above finished floor, terminating 60 NPS (1520 DN) above finished floor.

END OF SECTION

**SECTION 22 05 29 -
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment components for equipment, piping, and other plumbing work.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping 2014 (Reapproved 2020).
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).
- F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- I. MFMA-4 - Metal Framing Standards Publication 2004.
- J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.
- K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.05 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:

1. Comply with MSS SP-58.
 2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
 3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Metal Channel (Strut) Framing Systems:
1. Comply with MFMA-4.
 2. Channel Material:
 - a. Indoor Dry Locations: Use zinc-plated steel or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
- C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch (13 mm) diameter.
 - b. Piping larger than 1 inch (27 mm) nominal: 3/8 inch (10 mm) diameter.
 - c. Trapeze Support for Multiple Pipes: 3/8 inch (10 mm) diameter.
- D. Thermal Insulated Pipe Supports:
1. Manufacturers:
 - a. Buckaroos, Inc: www.buckaroos.com.
 - b. KB Enterprises: www.snappitz.com.
 - c. Substitutions: See Division 1.
 2. General Construction and Requirements:
 - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
 - b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
 - c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch (12.7 mm to 762 mm) iron pipes.
 - d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
 3. PVC Jacket:
 - a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
 - b. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
 - c. Maximum Service Temperature: 180 degrees F (82 degrees C).
 - d. Moisture Vapor Transmission: 0.0071 perm inch (0.0092 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
 - e. Thickness: 60 mil (1.524 mm).

4. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.
5. Products:
 - a. Buckaroos, Inc; CoolDry: www.buckaroos.com.
 - b. Substitutions: See Section 01 66 00 - Product Delivery, Storage and Handling.
- E. Pipe Supports:
 1. Manufacturers:
 - a. Carpenter & Paterson, Inc.
 - b. Clement Support Services.
 - c. Rilco Manufacturing Co. Inc.
 - d. Cooper B-Line or Tolco: www.eaton.com.
 - e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 2. Liquid Temperatures Up To 122 degrees F (50 degrees C):
 - a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
 - b. Support From Below: MSS SP-58 Types 35 through 38.
 3. Operating Temperatures from 122 to 446 degrees F (50 to 230 degrees C):
 - a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.
 - b. Roller Support: MSS SP-58 Types 41 or 43 through 46, with appropriate saddle of MSS SP-58 Type 39 for insulated pipe.
 - c. Sliding Support: MSS SP-58 Types 35 through 38.
- F. Pipe Stanchions: For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.
 1. Manufacturers:
 - a. Anvil International: www.anvilintl.com.
 - b. Cooper B-Line or Tolco: www.eaton.com.
 - c. Substitutions: See Division 1.
 - d. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
 3. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
- G. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
 1. Manufacturers:
 - a. Ferguson Enterprises Inc: www.fnw.com.
 - b. Cooper B-Line or Tolco: www.eaton.com.
 - c. Substitutions: See Section 01 66 00 - Product Delivery, Storage and Handling.
 - d. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 2. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
 3. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
- H. Riser Clamps:
 1. Manufacturers:
 - a. Ferguson Enterprises Inc: www.fnw.com.
 - b. Substitutions: See Section 01 66 00 - Product Delivery, Storage and Handling.
 - c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 2. Provide copper plated clamps for copper tubing support.

3. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
- I. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.
 1. Manufacturers:
 - a. Substitutions: See Division 1.
 - b. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- J. Strut Clamps: Two-piece pipe clamp.
 1. Manufacturers:
 - a. Ferguson Enterprises Inc www.fnw.com.
 - b. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- K. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.
- L. Pipe Hangers: For a given pipe run, use hangers of the same type and material.
 1. Manufacturers:
 - a. Ferguson Enterprises Inc: www.fnw.com.
 - b. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
 3. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
- M. Nonmetallic Pipe Hangers:
 1. Manufacturers:
 - a. DecoShield Systems, Inc; Snap-2 Hangers: www.decoshield.com.
- N. Intermediate Pipe Guides: Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.
 1. Manufacturers:
 - a. Anvil International: www.anvilintl.com.
 - b. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 2. Pipe Diameter 6 inches (150 mm) and Smaller: Provide minimum clearance of 0.16 inch (4 mm).
 3. Pipe Diameter 8 inches (200 mm): Provide U-bolts with double nuts providing minimum clearance of 0.28 inch (7 mm).
 4. Pipe Diameter 8 inches (200 mm): 0.625 inch (16 mm) U-bolt.
 5. Pipe Diameter 10 inches (250 mm): 0.75 inch (19 mm) U-bolt.
 6. Pipe Diameter 12 to 16 inches (300 to 400 mm): 0.875 inch (24 mm) U-bolt.
 7. Pipe Diameter 18 to 30 inches (450 to 750 mm): 1 inch (25 mm) U-bolt.
- O. Pipe Alignment Guides: Galvanized steel.
 1. Manufacturers:
 - a. Anvil International www.anvilintl.com.
 - b. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 2. Pipe Diameter 8 inches (200 mm) and Smaller: Spider or sleeve type.
 3. Pipe Diameter 10 inches (250 mm) and Larger: Roller type.
 4. Pipe Diameter 18 to 30 inches (450 to 750 mm): 1 inch (25 mm) U-bolt.
- P. Pipe Shields for Insulated Piping:
 1. Manufacturers:
 - a. Anvil International: www.anvilintl.com.
 - b. Substitutions: See Division 1.

- c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- 2. General Construction and Requirements:
 - a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
 - b. Shields Material: UV-resistant polypropylene with glass fill.
 - c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch (321 mm).
 - d. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
 - e. Maximum Service Temperature: 178 degrees F (81 degrees C).
 - f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
- Q. Anchors and Fasteners:
 - 1. Manufacturers - Mechanical Anchors:
 - a. Hilti, Inc: www.us.hilti.com.
 - b. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com.
 - c. Powers Fasteners, Inc: www.powers.com.
 - d. Simpson Strong-Tie Company Inc: www.strongtie.com.
 - e. Substitutions: See Division 1.
 - 2. Manufacturers - Powder-Actuated Fastening Systems:
 - a. Hilti, Inc: www.us.hilti.com.
 - b. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com.
 - c. Powers Fasteners, Inc: www.powers.com.
 - d. Simpson Strong-Tie Company Inc: www.strongtie.com.
 - e. Substitutions: See Division 1.
 - 3. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
 - 4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 - 5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
 - 6. Hollow Masonry: Use toggle bolts.
 - 7. Hollow Stud Walls: Use toggle bolts.
 - 8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
 - 9. Sheet Metal: Use sheet metal screws.
 - 10. Powder-actuated fasteners are not permitted.
 - 11. Hammer-driven anchors and fasteners are not permitted.
 - 12. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.
 - c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
- R. Pipe Installation Accessories:
 - 1. Copper Pipe Supports:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com.
 - 2) Substitutions: See Section 01 66 00 - Product Delivery, Storage and HandlingSee Division 1.
 - 3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.
 - 2. Overhead Pipe Supports:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com.
 - 2) Substitutions: See Division 1See Section 01 66 00 - Product Delivery, Storage and Handling.

- 3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.
3. Plenum Pipe Supports:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com.
 - 2) Substitutions: See Division 1.
 - 3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.
4. Inserts and Clamps:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com.
 - 2) Substitutions: See Division 1.
 - 3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- G. Equipment Support and Attachment:
 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 30 00.
 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
- I. Secure fasteners according to manufacturer's recommended torque settings.
- J. Remove temporary supports.

END OF SECTION

**SECTION 22 05 48 -
VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Vibration isolators.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.

1.03 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.
- C. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 - 1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.

1.06 QUALITY ASSURANCE

- A. Comply with 2019 CBC.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Project applicability: Vibration isolation is only required for piping located above grade and these areas below.
 - 1. For all piping located above grade and 7' within Gridline e1.75.
 - 2. For condensate piping for the Admin Building, Class Lab 1, Class Lab 2 & Class Lab 3.

- B. Provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing plumbing equipment and/or plumbing connections to vibration-isolated equipment.
- C. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- D. General Requirements:
 - 1. Select vibration isolators to provide required static deflection.
 - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

2.02 VIBRATION ISOLATORS

- A. Manufacturers:
 - 1. Vibration Isolators:
 - a. Kinetics Noise Control, Inc: www.kineticsnoise.com.
 - b. Mason Industries: www.mason-ind.com.
 - c. Vibration Eliminator Company, Inc: www.veco-nyc.com.
 - d. Substitutions: See Division 1.
- B. Piping Isolation for Noise Control
 - 1. Isolate water piping from structure with HoldRite system products including but not limited to the following:
 - a. Thru-stud isolator/suspension clamps.
 - b. Neoprene waffle pads, 3/4" thick.
 - c. Isolation felt, min 1/4" thick.
 - d. Sound rated variable closure clampst with polymer isolator inserts.
 - e. Thru-wall pipe supports
- C. Do not allow direct pipe to structure contact.
- D. Support riser clamps on waffle pads
- E. For wet walls with a double wall between a restroom and noise sensitive spaces (office, library, classroom, etc.), mount piping only on the restroom wall framing, with no contact with the wall framing for the sensitive space(s).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- E. Vibration Isolation Systems:
 - 1. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 - 2. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.

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3. Adjust isolators to be free of isolation short circuits during normal operation.
4. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

END OF SECTION

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**SECTION 22 05 53 -
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe markers.
- E. Ceiling tacks.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 01 Specification Sections, apply to this section

1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Air Terminal Units: Tags.
- C. Automatic Controls: Tags. Key to control schematic.
- D. Control Panels: Nameplates.
- E. Dampers: Ceiling tacks, where located above lay-in ceiling.
- F. Ductwork: Nameplates.
- G. Heat Transfer Equipment: Nameplates.
- H. Instrumentation: Tags.
- I. Major Control Components: Nameplates.
- J. Piping: Tags.
- K. Pumps: Nameplates.
- L. Relays: Tags.
- M. Small-sized Equipment: Tags.
- N. Tanks: Nameplates.
- O. Thermostats: Nameplates.
- P. Valves: Tags and ceiling tacks where located above lay-in ceiling.
- Q. Water Treatment Devices: Nameplates.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Brimar Industries, Inc www.pipemarker.com.

2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
 3. Seton Identification Products: www.seton.com.
 4. Substitutions: See Division 1.
- B. Description: Laminated three-layer plastic with engraved letters.
1. Letter Color: White.
 2. Letter Height: 1/4 inch (6 mm).
 3. Background Color: Black.
 4. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Manufacturers:
1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
 2. Brady Corporation www.bradycorp.com.
 3. Brimar Industries, Inc: www.pipemarker.com.
 4. Craftmark Pipe Markers: www.craftmarkid.com.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.
- C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.
- D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 STENCILS

- A. Manufacturers:
1. Brady Corporation: www.bradycorp.com.
 2. Craftmark Pipe Markers: www.craftmarkid.com.
 3. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
 4. Seton Identification Products: www.seton.com.
- B. Stencils: With clean cut symbols and letters of following size:
1. 3/4 to 1-1/4 inch (20-30 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 1/2 inch (15 mm) high letters.
 2. 1-1/2 to 2 inch (40-50 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 3/4 inch (20 mm) high letters.
 3. 2-1/2 to 6 inch (65-150 mm) Outside Diameter of Insulation or Pipe: 12 inch (300 mm) long color field, 1-1/4 inch (30 mm) high letters.
 4. 8 to 10 inch (200-250 mm) Outside Diameter of Insulation or Pipe: 24 inch (600 mm) long color field, 2-1/2 inch (65 mm) high letters.
 5. Over 10 inch (250 mm) Outside Diameter of Insulation or Pipe: 32 inch (800 mm) long color field, 3-1/2 inch (90 mm) high letters.
 6. Ductwork and Equipment: 2-1/2 inch (65 mm) high letters.
- C. Stencil Paint: As specified in Section 09 91 23, semi-gloss enamel, colors complying with ASME A13.1.

2.05 PIPE MARKERS

- A. Manufacturers:
1. Brady Corporation: www.bradycorp.com.
 2. Brimar Industries, Inc: www.pipemarker.com.
 3. Craftmark Pipe Markers: www.craftmarkid.com.
 4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
- B. Comply with ASME A13.1.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

- D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.
- F. Color code as follows:
 - 1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.

2.06 CEILING TACKS

- A. Manufacturers:
 - 1. Craftmark Pipe Markers: www.craftmarkid.com.
 - 2. Substitutions: See Division 1.
- B. Description: Steel with 3/4 inch (20 mm) diameter color coded head.
- C. Color code as follows:
 - 1. HVAC Equipment: Yellow.
 - 2. Fire Dampers and Smoke Dampers: Red.
 - 3. Plumbing Valves: Green.
 - 4. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Apply stencil painting in accordance with Section 09 90 00.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.
- G. Use tags on piping 3/4 inch (20 mm) diameter and smaller.
 - 1. Identify service, flow direction, and pressure.
 - 2. Install in clear view and align with axis of piping.
 - 3. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

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**SECTION 22 07 19 -
PLUMBING PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including general and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 09090 00 - Painting

1.03 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.
- D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement 2007 (Reapproved 2013).
- E. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement 2007 (Reapproved 2013).
- F. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- G. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation 2017.
- H. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
- I. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2019.
- J. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- L. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Division 101 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com.
 - 2. Johns Manville Corporation: www.jm.com.
 - 3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: www.knaufinsulation.com.
 - 4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com.
 - 5. Owens Corning Corporation; VaporWick Pipe Insulation: www.ocbuildingspec.com.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
 - 2. Maximum Service Temperature: 850 degrees F (454 degrees C).
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
 - 1. K (Ksi) Value: ASTM C177, 0.23 at 75 degrees F (0.034 at 24 degrees C).
 - 2. Maximum Service Temperature: 220 degrees F (104 degrees C).
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- D. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
 - 1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
 - 2. Maximum Service Temperature: 650 degrees F (343 degrees C).
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- E. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/Pa s m).
- F. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.
- G. Vapor Barrier Lap Adhesive: Compatible with insulation.
 - 1. Manufacturers:
 - a. Childers Brand, Specialty Construction Brands, Inc.
- H. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
 - 1. Manufacturers:
 - a. Childers Brand, Specialty Construction Brands, Inc.
- I. Fibrous Glass Fabric:
 - 1. Manufacturers:
 - a. Childers Brand, Specialty Construction Brands, Inc.
 - 2. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
 - 3. Blanket: 1.0 lb/cu ft (16 kg/cu m) density.
 - 4. Weave: 5 by 5.
- J. Indoor Vapor Barrier Finish:
 - 1. Manufacturers:

- a. Childers Brand, Specialty Construction Brands, Inc.
 - b. Substitutions: See Section 01 66 00 - Product Delivery, Storage and HandlingSee Division 1.
- K. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
 - 1. Manufacturers:
 - a. Childers Brand, Specialty Construction Brands, Inc.
 - b. Substitutions: See Section 01 66 00 - Product Delivery, Storage and HandlingSee Division 1.
- L. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
 - 1. Manufacturers:
 - a. Childers Brand, Specialty Construction Brands, Inc.
 - b. Substitutions: See Section 01 66 00 - Product Delivery, Storage and HandlingSee Division 1.
- M. Insulating Cement: ASTM C449.
 - 1. Manufacturers:
 - a. Childers Brand, Specialty Construction Brands, Inc.
 - b. Substitutions: See Section 01 66 00 - Product Delivery, Storage and HandlingSee Division 1.

2.03 HYDROUS CALCIUM SILICATE

- A. Manufacturers:
 - 1. Johns Manville Corporation: www.jm.com.
 - 2. Substitutions: See Division 1See Section 01 66 00 - Product Delivery, Storage and Handling.
- B. Insulation: ASTM C533 and ASTM C795; rigid molded, asbestos free, gold color.
 - 1. K (Ksi) Value: 0.40 at 300 degrees F (0.057 at 149 degrees C) when tested in accordance with ASTM C177 or ASTM C518.
 - 2. Maximum Service Temperature: 1200 degrees F (649 degrees C).
 - 3. Density: 15 lb/cu ft (240 kg/cu m).

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
 - 1. Aeroflex USA, Inc; Aerocel Stay-Seal with Protape (SSPT): www.aeroflexusa.com.
 - 2. Armacell LLC; AP Armaflex: www.armacell.us.
 - 3. K-Flex USA LLC; Insul-Tube: www.kflexusa.com.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
 - 1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
 - 2. Maximum Service Temperature: 220 degrees F (104 degrees C).
 - 3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.05 JACKETS

- A. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
 - 1. Thickness: 0.016 inch (0.40 mm) sheet.
 - 2. Finish: smooth or embossed.
 - 3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
 - 4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. Glass fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- H. Inserts and Shields:
 - 1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert Location: Between support shield and piping and under the finish jacket.
 - 4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.
- J. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
- K. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.
- L. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULES

- A. Plumbing Systems:
 - 1. Domestic Hot Water Supply:
 - a. Glass Fiber Insulation:
 - 1) Thickness: 1 inch (25.4 mm).
 - b. Cellular Foam Insulation:
 - 1) Thickness: 1 inch (25.4 mm).

END OF SECTION

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SECTION 22 10 02 - PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe, pipe fittings, specialties, and connections for piping systems.
 - 1. Sanitary sewer.
 - 2. Domestic water.
 - 3. Flanges, unions, and couplings.
 - 4. Manufactured sleeve-seal systems.
 - 5. Valves.

1.02 RELATED REQUIREMENTS

- A. Division 22 Section "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building
- B. Section 08 31 00 - Access Doors and Panels.
- C. Section 09 90 00 Painting
- D. Section 22 05 16 - Flexible Fittings for Plumbing Piping.
- E. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- F. Section 31 23 33 - Trenching, Backfilling and Compacting.

1.03 REFERENCE STANDARDS

- A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems 2015 (Reaffirmed 2020).
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2018.
- D. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes 2018.
- E. ASME B31.9 - Building Services Piping 2020.
- F. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers 2021.
- G. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.
- H. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).
- I. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings 2021.
- J. ASTM B32 - Standard Specification for Solder Metal 2020.
- K. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes 2020.
- L. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.
- M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
- N. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.
- O. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.
- P. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings 2020a.
- Q. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings 2004 (Reapproved 2016).

- R. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings 2014, with Editorial Revision (2018).
- S. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2011 (Amended 2012).
- T. AWWA C606 - Grooved and Shouldered Joints 2015.
- U. AWWA C651 - Disinfecting Water Mains 2014.
- V. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications 2017 (Revised 2018).
- W. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2012 (Revised 2018).
- X. MSS SP-67 - Butterfly Valves 2017.
- Y. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010.
- Z. NSF 61 - Drinking Water System Components - Health Effects 2020.
- AA. NSF 372 - Drinking Water System Components - Lead Content 2020.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Shop Drawings: For the purposes of coordinating architectural aesthetics, submit shop drawings including 1/48th scale plans and elevations for the following areas:
 - 1. Indoor sinks with sediment traps below counter including drainage and water systems.
 - 2. Outdoor wall mounted sinks with sediment traps below counter including drainage and water systems.
 - 3. Water heaters showing clearances are being provided with relation to all other nearby trades.
- D. Project Record Documents: Record actual locations of valves.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
- D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
- E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET (1500 MM) OF BUILDING

- A. Cast Iron Pipe: ASTM A74 extra heavy weight.
 - 1. Fittings: Cast iron.
 - 2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

2.03 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

- A. Cast Iron Pipe: ASTM A74 extra heavy weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

2.04 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
- C. ABS Pipe: ASTM F628 (GREENHOUSE VENT PIPE ONLY).
 - 1. Fittings: ABS.
 - 2. Joints: Solvent welded with ASTM D2235 cement.
- D. ABS Pipe: ASTM D2661 (GREENHOUSE VENT PIPE ONLY).
 - 1. Fittings: ABS.
 - 2. Joints: Solvent welded with ASTM D2235 cement.

2.05 DOMESTIC WATER PIPING, BURIED BEYOND 5 FEET (1500 MM) OF BUILDING

- A. Copper Pipe: ASTM B42, hard drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.
 - 3. Joints: AWS A5.8M/A5.8, BCuP copper/silver braze.
- B. Copper Pipe: ASTM B42, annealed.
 - 1. Fittings: ASME B16.26, cast bronze.
 - 2. Joints: Flared.

2.06 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

- A. Copper Pipe: ASTM B42, hard drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.
 - 3. Joints: AWS A5.8M/A5.8, BCuP copper/silver braze.
- B. Copper Pipe: ASTM B42, annealed.
 - 1. Fittings: ASME B16.26, cast bronze.
 - 2. Joints: Flared.

2.07 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Fittings: Cast iron, coated.
3. Joints: ASTM B32, alloy Sn95 solder.
4. Joints: Grooved mechanical couplings.
5. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.
 - a. Manufacturers:
 - 1) Anvil International: www.anvilintl.com.
 - 2) Apollo Valves: www.apollovalves.com.
 - 3) Grinnell Products: www.grinnell.com.
 - 4) Viega LLC: www.viega.us.
 - 5) Substitutions: See Division 1.

2.08 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
 2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Size Over 1 Inch (25 mm):
 1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
 2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
 1. Dimensions and Testing: In accordance with AWWA C606.
 2. Housing Material: Provide ASTM A47/A47M malleable iron or ductile iron, galvanized.
 3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F (minus 34 degrees C) to 230 degrees F (110 degrees C).
 4. Gasket Material: Nitrile rubber suitable for operating temperature range from minus 20 degrees F to 180 degrees F (minus 29 degrees C to 82 degrees C).
 5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
 6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
 7. Manufacturers:
 - a. Anvil International www.anvilintl.com.
 - b. Apollo Valves: www.apollovalves.com.
 - c. Grinnell Products www.grinnell.com.
 - d. Substitutions: See Division 1.
- D. No-Hub Couplings:
 1. Gasket Material: Neoprene complying with ASTM C564.
 2. Band Material: Stainless steel.
 3. Eyelet Material: Stainless steel.
 4. Manufacturers:
 - a. MIFAB, Inc: www.mifab.com.
 - b. Substitutions: See Division 1.

2.09 MANUFACTURED SLEEVE-SEAL SYSTEMS

- A. Modular/Mechanical Seal:
 1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
 2. Provide watertight seal between pipe and wall/casing opening.

3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

2.10 BALL VALVES

- A. Manufacturers:
 1. Anvil International: www.anvilintl.com.
 2. Apollo Valves: www.apollovalves.com.
 3. Grinnell Products: www.grinnell.com.
 4. Nibco, Inc: www.nibco.com.
- B. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

2.11 BUTTERFLY VALVES

- A. Manufacturers:
 1. Anvil International: www.anvilintl.com.
 2. Apollo Valves: www.apollovalves.com.
 3. Crane Company: www.cranecpe.com.
 4. Grinnell Products; B302: www.grinnell.com.
- B. Construction 1-1/2 Inches (40 mm) and Larger: MSS SP-67, 200 psi (1380 kPa) CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.
- C. Provide gear operators for valves 8 inches (150 mm) and larger, and chain-wheel operators for valves mounted over 8 feet (2400 mm) above floor.

2.12 PIPING SPECIALTIES

- A. Flow Controls:
 1. Manufacturers:
 - a. Anvil International: www.anvilintl.com.
 - b. ITT Bell & Gossett: www.bellgossett.com.
 - c. Griswold Controls: www.griswoldcontrols.com.
 - d. Taco, Inc: www.taco-hvac.com.
 - e. Substitutions: See Section 01 66 00 - Product Delivery, Storage and Handling.
 2. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
 3. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi (24 kPa).

2.13 RELIEF VALVES

- A. Pressure:
 1. Manufacturers:
 - a. Cla-Val Co: www.cla-val.com.
 - b. Henry Technologies: www.henrytech.com.
 - c. Watts Regulator Company: www.wattsregulator.com.
 - d. Substitutions: See Section 01 66 00 - Product Delivery, Storage and Handling.
 2. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
- B. Temperature and Pressure:
 1. Manufacturers:
 - a. Cla-Val Co: www.cla-val.com.
 - b. Watts Regulator Company: www.wattsregulator.com.

- c. Substitutions: See Section 01 66 00 - Product Delivery, Storage and Handling.
- 2. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F (98.9 degrees C), capacity ASME BPVC-IV certified and labelled.

2.14 STRAINERS

- A. Manufacturers:
 - 1. Armstrong International, Inc: www.armstronginternational.com.
 - 2. Green Country Filter Manufacturing: www.greencountryfilter.com.
 - 3. WEAMCO: www.weamco.com.
 - 4. Substitutions: See Section 01 66 00 - Product Delivery, Storage and Handling.
- B. Size 2 Inches (50 mm) and Under:
 - 1. Threaded brass body for 175 psi (1200 kPa) CWP, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
 - 2. Class 150, threaded bronze body 300 psi (2070 kPa) CWP, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 16.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed.
 - 1. Coordinate size and location of access doors with Section 08 31 00.
- I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
- J. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.
 - 1. See Section 09 90 00 for painting of plumbing systems and components.
- K. Excavate in accordance with Section 31 23 16.
- L. Backfill in accordance with Section 31 23 23.
- M. Install bell and spigot pipe with bell end upstream.
- N. Install valves with stems upright or horizontal, not inverted. Refer to Section 22 05 23.
- O. Install water piping to ASME B31.9.

- P. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- Q. Manufactured Sleeve-Seal Systems:
 - 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 - 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 - 3. Locate piping in center of sleeve or penetration.
 - 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 - 5. Tighten bolting for a watertight seal.
 - 6. Install in accordance with manufacturer's recommendations.

3.04 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed, and clean.
- B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.05 SCHEDULES

- A. Pipe Hanger Spacing:
 - 1. Metal Piping:
 - a. Pipe Size: 1/2 inches (15 mm) to 1-1/4 inches (32 mm):
 - 1) Maximum Hanger Spacing: 6.5 ft (2 m).
 - 2) Hanger Rod Diameter: 3/8 inches (9 mm).
 - b. Pipe Size: 1-1/2 inches (40 mm) to 2 inches (50 mm):
 - 1) Maximum Hanger Spacing: 10 ft (3 m).
 - 2) Hanger Rod Diameter: 3/8 inch (9 mm).
 - c. Pipe Size: 2-1/2 inches (65 mm) to 3 inches (75 mm):
 - 1) Maximum Hanger Spacing: 10 ft (3 m).
 - 2) Hanger Rod Diameter: 1/2 inch (13 mm).
 - d. Pipe Size: 4 inches (100 mm) to 6 inches (150 mm):
 - 1) Maximum Hanger Spacing: 10 ft (3 m).
 - 2) Hanger Rod Diameter: 5/8 inch (15 mm).
 - 2. Plastic Piping:
 - a. All Sizes:
 - 1) Maximum Hanger Spacing: 6 ft (1.8 m).
 - 2) Hanger Rod Diameter: 3/8 inch (9 mm).

END OF SECTION

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**SECTION 22 10 06 -
PLUMBING PIPING SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Drains.
- B. Cleanouts.
- C. Hose bibbs.
- D. Hydrants.
- E. Water hammer arrestors.
- F. Sanitary waste interceptors.
- G. Mixing valves.

1.02 RELATED REQUIREMENTS

- A. Section 22 10 05 - Plumbing Piping.
- B. Section 22 30 00 - Plumbing Equipment.
- C. Section 22 40 00 - Plumbing Fixtures.
- D. Division 26: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers 2017.
- B. NSF 61 - Drinking Water System Components - Health Effects 2020.
- C. NSF 372 - Drinking Water System Components - Lead Content 2020.
- D. PDI-WH 201 - Water Hammer Arresters 2017.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Operation Data: Indicate frequency of treatment required for interceptors.
- E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 - 2. Josam Company: www.josam.com.
 - 3. Zurn Industries, LLC: www.zurn.com.

4. Substitutions: See Division 1.
- B. Floor Drain (FD-1):
 1. Dura-Coated cast iron body with bottom outlet, combination invertible membrane clamp and adjustable collar with seepage slots and "TYPE B" stainless steel, light-duty strainer.
- C. Floor Drain (FD-2):
 1. Dura-Coated cast iron body with bottom outlet, combination invertible membrane clamp and adjustable collar with seepage slots and "TYPE BL" D.C.C.I. wide flanged head and stainless steel, light-duty strainer.
- D. Prefabricated Floor Trench (FD-3):
 1. High density Polyethelene (HDPE) channels with stainless steel frames and adjustable leveling feet along the length of the trough.
 2. Body: Glass fiber reinforced polymer concrete cast in standard or custom assembly with integral aluminum load bearing frame and concrete anchors.
 3. Section Width: 6 inches (152.4 mm).
 4. Section Length: As indicated on drawings with 0.5 percent slope.
 5. Section Sealing: Urethane caulk.
 6. Grate: HDPE, heel-proof paver slot for light traffic.

2.03 CLEANOUTS

- A. Manufacturers:
 1. Jay R. Smith Manufacturing Company www.jayrsmith.com.
 2. Josam Company: www.josam.com.
 3. MIFAB, Inc: www.mifab.com.
 4. Zurn Industries, LLC: www.zurn.com.
 5. Substitutions: See Section 01 66 00 - Product Delivery, Storage and Handling See Division 1.
- B. Cleanouts at Exterior Surfaced Areas :
 1. Round cast nickel bronze access frame and non-skid cover.
- C. Cleanouts at Exterior Unsurfaced Areas :
 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.
- D. Cleanouts at Interior Finished Floor Areas :
 1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.
- E. Cleanouts at Interior Finished Wall Areas :
 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.
- F. Cleanouts at Interior Unfinished Accessible Areas (CO-5): Calked or threaded type.
Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HOSE BIBBS

- A. Manufacturers:
 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 2. Murdock Manufacturing, Inc: www.murdockmfg.com.
 3. Watts Regulator Company: www.wattsregulator.com.
 4. Zurn Industries, LLC: www.zurn.com.
 5. Substitutions: See Section 01 66 00 - Product Delivery, Storage and Handling See Division 1.
- B. Interior Hose Bibbs:

1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with handwheel, integral vacuum breaker in compliance with ASSE 1011.

2.05 WATER HAMMER ARRESTORS

- A. Manufacturers:
 1. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com.
 2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 3. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com.
 4. Zurn Industries, LLC: www.zurn.com.
 5. Substitutions: See Section 01 66 00 - Product Delivery, Storage and HandlingSee Division 1.
- B. Water Hammer Arrestors:
 1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F (minus 73 to 149 degrees C) and maximum 250 psi (1700 kPa) working pressure.

2.06 SANITARY WASTE INTERCEPTORS

- A. Manufacturers:
 1. Jay R. Smith Manufacturing Company: www.jrsmith.com.
 2. MIFAB, Inc: www.mifab.com.
 3. Zurn Industries, LLC: www.zurn.com.
- B. Sand/Sediment Interceptors:
 1. Epoxy coated cast iron body and secured cover with removable stainless steel sediment bucket.

2.07 MIXING VALVES

- A. Thermostatic Mixing Valves:
 1. Manufacturers:
 - a. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com.
 - b. ESBE: www.esbe.se/en.
 - c. Honeywell International Inc: www.honeywellhome.com.
 - d. Leonard Valve Company: www.leonardvalve.com.
 - e. Substitutions: See Section 01 66 00 - Product Delivery, Storage and HandlingSee Division 1.
 2. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
 3. Accessories:
 - a. Check valve on inlets.
 - b. Volume control shut-off valve on outlet.
 - c. Stem thermometer on outlet.
 - d. Strainer stop checks on inlets.
 4. Cabinet: 16 gauge, 0.0598 inch (1.52 mm) prime coated steel, for recessed mounting with keyed lock.

2.08 RELIEF VALVES

- A. Manufacturers:
 1. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com.
 2. ITT Bell & Gossett: www.bellgossett.com.
 3. Substitutions: See Division 1.
- B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.09 AIR VENTS

- A. Manufacturers:
 - 1. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com.
 - 2. ITT Bell & Gossett: www.bellgossett.com.
 - 3. Substitutions: See Division 1.
- B. Manual Type: Short vertical sections of 2 inch (50 mm) diameter pipe to form air chamber, with 1/8 inch (3 mm) brass needle valve at top of chamber.

2.10 FLOOR DRAIN TRAP SEALS

- A. Manufacturers:
 - 1. MIFAB, Inc: www.mifab.com.
 - 2. Precision Plumbing Products: www.pppinc.net.
 - 3. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com.
- B. Description: Push-fit EPDM or silicone fitting with a one-way membrane.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
- F. Pipe relief from backflow preventer to nearest drain.
- G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks or water closets.
- H. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch (20 mm) minimum, and minimum 18 inches (450 mm) long.

END OF SECTION

**SECTION 22 30 00 -
PLUMBING EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water Heaters:
 - 1. Residential electric.
 - 2. Commercial electric.
 - 3. Tankless electric.

1.02 RELATED REQUIREMENTS

- A. Division 26: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.
- B. Product Data:
 - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
 - 2. Indicate pump type, capacity, power requirements.
 - 3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
 - 4. Provide electrical characteristics and connection requirements.
- C. Shop Drawings:
 - 1. Indicate water heater dimensions, maintenance clearances, size of tappings, and performance data.
- D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- F. Project Record Documents: Record actual locations of components.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Certifications:
 - 1. Water Heaters: NSF approved.
 - 2. Electric Water Heaters: UL listed and labeled to UL 174.
 - 3. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.07 WARRANTY

- A. See Section 01 77 00 - Contract Closeout and Final Cleaning, for additional warranty requirements.
- B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 WATER HEATERS

- A. Manufacturers:
 - 1. A.O. Smith Water Products Co: www.hotwater.com.
 - 2. Rheem Manufacturing Company: www.rheem.com.
 - 3. Hubbell: www.hubbelheaters.com.
 - 4. Substitutions: See Division 1 See Section 01 66 00 - Product Delivery, Storage and Handling.
- B. Tankless Electric:
 - 1. Type: Automatic, electric.
 - 2. Performance:
 - a. See plans for capacities and amperage.
 - b. Maximum Working Pressure: 150 psig (1000 kPa).
 - 3. Electrical Characteristics:
 - a. 208 volts, single phase (see plans for where occurs).
 - b. [208] volts, three phase (see plans for where occurs).
 - 4. Controls: Automatic water thermostat with externally adjustable temperature range from 120 to 170 degrees F (49 to 77 degrees C), flanged or screw-in nichrome elements, enclosed controls and electrical junction box and operating light.
 - 5. Accessories:
 - a. Water Connections: Brass.
 - b. Dip Tube: Brass.
 - c. Drain valve.
 - d. Anode: Magnesium.
 - e. Temperature and Pressure Relief Valve: ASME labeled.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related electrical work to achieve operating system.

END OF SECTION

**SECTION 22 40 00 -
PLUMBING FIXTURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water closets.
- B. Lavatories.
- C. Sinks.
- D. Mop sinks.
- E. Drinking fountains.
- F. Eye and face wash fountains.

1.02 RELATED REQUIREMENTS

- A. Section 22 10 05 - Plumbing Piping.
- B. Section 22 10 06 - Plumbing Piping Specialties.
- C. Section 22 30 00 - Plumbing Equipment.
- D. Division 26: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment 2014.
- C. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- D. ASME A112.19.2 - Ceramic Plumbing Fixtures 2018, with Errata.
- E. ASME A112.19.3 - Stainless Steel Plumbing Fixtures 2017, with Errata.
- F. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices 2020.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- H. IAPMO Z124 - Plastic Plumbing Fixtures 2017, with Errata.
- I. NSF 61 - Drinking Water System Components - Health Effects 2020.
- J. NSF 372 - Drinking Water System Components - Lead Content 2020.
- K. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Manufacturer's Instructions: Indicate installation methods and procedures.
- D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 66 00 - Product Delivery, Storage and Handling, for additional provisions.
 - 2. Extra Faucet Washers: One set of each type and size.
 - 3. Extra Toilet Seats: One of each type and size.

4. Flush Valve Service Kits: One for each type and size.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.07 WARRANTY

- A. See Section 01 77 00 - Contract Closeout and Final Cleaning, for additional warranty requirements.
- B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
- B. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.

2.02 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for installation of plumbing systems.
- B. Comply with UL (DIR) requirements.
- C. Perform work in accordance with local health department regulations.
- D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

2.03 FLUSH VALVE WATER CLOSETS

- A. Water Closets: Vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, china bolt caps.
 1. Flush Valve: Exposed (top spud).
 2. Flush Operation: Manual, oscillating handle.
 3. Handle Height: 44 inches (1117 mm) or less.
 4. Manufacturers:
 - a. American Standard, Inc: www.americanstandard-us.com.
 - b. Kohler Company: www.kohler.com.
 - c. Zurn Industries, Inc: www.zurn.com.
- B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
 1. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
 2. Manufacturers:
 - a. Kohler: www.kohler.com.
 - b. Toto: www.totousa.com.
 - c. Substitutions: See Division 1.

2.04 WALL-HUNG MULTI-STATION LAVATORY UNITS - SOLID SURFACE

- A. Description: Rectilinear, level-surface deck, seamless and integral elongated basin, with stainless steel enclosed pedestal cabinet.
- B. Deck and Bowl Material: Fabricate from molded engineered stone material consisting of natural quartz, granite, and other minerals in a matrix of thermoset acrylic modified bio-

based polyester resin and meeting requirements of IAPMO Z124.

- C. Surface Burning Characteristics: Smoke developed index less than 450, and flame spread index less than 25, Class A, when tested in accordance with ASTM E84.
- D. Number of Wash Stations: One or Two, see plans and equipment schedule.
- E. Unit Length: see plans and equipment sche.
- F. Soap Dispenser:
 - 1. Deck-mounted, sensor-operated, chrome-plated plastic, with LED battery and soap level indicators, battery box and batteries and 27 ounce (798 ml) bottle of 1000 shot soap.
- G. Water Supply: Thermostatic mixing valve assembly.
- H. Color: As selected by Architect from manufacturer's full line.
- I. Faucet Drilling: 4 inch (100 mm) centerset drilling.
- J. Sensor-Operated Faucets:
 - 1. High profile metering faucet with infrared and external temperature control.
 - 2. Vandal-resistant meeting requirements of ASME A112.18.1 and ADA Standards compliant.
 - 3. Body: Polished chrome plated commercial solid cast brass, with 4 inch (102 mm) centerset mounting with anti-rotation trim plate.
 - 4. Tempered Water Supply: ADA Standards compliant lever on faucet body.
 - 5. Aerator: Flow rate of 0.35 gal/min (1.32 L/s) at an operating range of 20 to 80 psi (138 to 552 kPa).
 - 6. Sensor Module: Water conserving, vandal-resistant adjustable sensor unit with timing turn-off delay and stationary object automatic timed cutoff, with battery diagnostic light, serviceable from above deck.
 - 7. Power Supply: Battery-operated single faucet with 6V lithium battery and single 115 VAC plug-in adapter.
- K. Access Panel: integrated into lower integrated enclosure.
- L. Support Frame: Wall mounted, heavy gauge, stainless steel Z-brackets.
- M. Manufacturers:
 - 1. Bradley Corporation: www.bradleycorp.com.
 - 2. Substitutions: See Division 1.

2.05 WALL-HUNG MULTI-STATION WASH FOUNTAINS - STAINLESS STEEL

- A. Description: Rectangular, level-surface deck, rolled edges, seamless and integral elongated basin, with stainless steel enclosed pedestal cabinet.
- B. Deck and Bowl Material: 14 gauge, stainless steel with satin finish. Provide unit with integral backsplash and tubular steel support wall brackets below.
- C. Surface Burning Characteristics: Smoke developed index less than 450, and flame spread index less than 25, Class A, when tested in accordance with ASTM E84.
- D. Number of Wash Stations: One or Two, see plans and fixture scheudule.
- E. Unit Length: Varies, see plans and fixture scheudule.
- F. Provide with soap dispenser.
- G. Water Supply: Thermostatic mixing valve assembly.
- H. Faucet Drilling: Install per manufacturers instructions.
- I. Wall mounted faucet controls, ADA handles for ADA locations and low flow aerator for all locations.
- J. Support Frame: Wall mounted, heavy gauge, stainless steel legs with wall flanges. Floor supported models are not acceptable.

- K. Manufacturers:
 - 1. Advance Tabco: www.advancetabco.com.
 - 2. Elkay: www.elkay.com.
 - 3. Substitutions: See Division 1.

2.06 KITCHEN SINKS

- A. Sink Manufacturers:
 - 1. American Standard, Inc: www.americanstandard-us.com.
 - 2. Kohler Company: www.kohler.com.
 - 3. Elkay: www.elkay.com
 - 4. Substitutions: See Division 1.
- B. Single Compartment Bowl: 20 gauge, 0.0359 inch (0.91 mm) thick, Type 302 stainless steel; see plans and fixture schedule for dimensions, mounting styles and hole patterns required for each location.
 - 1. Drain: 3-1/2 inch (90 mm) SS screen cup and tailpiece.

2.07 DRINKING FOUNTAINS - OUTDOOR

- A. Manufacturers:
 - 1. Elkay Manufacturing Company: www.elkay.com.
- B. Fountain: 304 stainless steel with underside vandal proof cowling, hooded elevated anti-squirt bubbler with stream guard, automatic stream regulator, cross handle, mounting bracket, screwdriver stop.
- C. Color: evergreen.

2.08 DRINKING FOUNTAINS - BOTTLE FILLERS

- A. Manufacturers:
 - 1. Elkay Manufacturing Company: www.elkay.com.
 - 2. Substitutions: See Division 1.
- B. Bottle Filler: Materials and color to match fountain.
- C. Lead-free waterways.
- D. Hands free operation.
- E. Filter replacement indicator.

2.09 MOP SINKS

- A. Mop Sink Manufacturers:
 - 1. Acorn Engineering Company: www.acorneng.com.
 - 2. Fiat Products: www.fiat.ca.
 - 3. Zurn Industries, Inc.: www.zurn.com.
 - 4. Substitutions: See Division 1.
- B. Material: Terrazo with stainless steel curb cap on all sides.
- C. Type: Rectilinear.
- D. Dimensions: As indicated on drawings.
- E. Accessories:
 - 1. 5 feet (1.5 m) of 1/2 inch (13 mm) diameter plain end reinforced plastic hose with vacuum breaker.
 - 2. Hose clamp hanger.
 - 3. Mop hanger.
- F. Preparation: install on wet mortar bed to prevent cracking.

2.10 EMERGENCY EYE AND FACE WASH

- A. Emergency Wash Manufacturers:

1. Haws Corporation: www.hawesco.com
 2. Substitutions: See Division 1.
- B. Emergency Wash: ANSI Z358.1; counter top, self-cleaning, non-clogging eye and face wash with quick opening, full-flow valves, countertop sink eye and face wash receptor, twin eye wash heads on swiveling countertop mounted arm, dust covers, copper alloy control valve and fittings.
- C. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1070 listed, with combination stop, strainer, and check valves, and flexible stainless steel connectors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall supports and bolts.

3.04 CLEANING

- A. Clean plumbing fixtures and equipment.

3.05 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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**SECTION 23 05 17 -
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe sleeves.
- B. Manufactured sleeve-seal systems.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03 REFERENCE STANDARDS

- A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2016.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

1.04 SUBMITTALS

- A. See Division 1, for submittal procedures.
- B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Division 1, for additional provisions.
 - 2. Extra Valve Stem Packings: Two for each type and size of valve.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified this section.
 - 1. Minimum three years experience.
 - 2. Approved by manufacturer.
- C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 WARRANTY

- A. See Section See Division 1, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

- A. Manufacturers:
 - 1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com.
- B. Vertical Piping:
 - 1. Sleeve Length: 1 inch (25 mm) above finished floor.
 - 2. Provide sealant for watertight joint.

3. Blocked Out Floor Openings: Provide 1-1/2 inch (40 mm) angle set in silicon adhesive around opening.
4. Drilled Penetrations: Provide 1-1/2 inch (40 mm) angle ring or square set in silicone adhesive around penetration.
- C. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- D. Pipe Passing Through Below Grade Exterior Walls:
 1. Zinc coated or cast iron pipe.
 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- E. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 2. Connect sleeve with floor plate except in mechanical rooms.
- F. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 2. Connect sleeve with floor plate except in mechanical rooms.
- G. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.
- H. Clearances:
 1. Provide allowance for insulated piping.
 2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch (25 mm) greater than external; pipe diameter.
 3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

2.02 MANUFACTURED SLEEVE-SEAL SYSTEMS

- A. Manufacturers:
 1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com.
 2. Flexicraft Industries; PipeSeal: www.flexicraft.com.
 3. CALPICO, Inc..
 4. Metraflex Company (The).
- B. Modular/Mechanical Seal:
 1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
 2. Provide watertight seal between pipe and wall/casing opening.
 3. Elastomer element size and material in accordance with manufacturer's recommendations.
 4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.
- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Inserts:
 1. Provide inserts for placement in concrete formwork.
 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 m).
 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- E. Structural Considerations:
1. Do not penetrate building structural members unless indicated.
- F. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
1. Aboveground Piping:
 - a. Pack solid using mineral fiber in compliance with ASTM C592.
 - b. Fill space with an elastomer caulk to a depth of 0.50 inch (15 mm) where penetrations occur between conditioned and unconditioned spaces.
 2. All Rated Openings: Caulk tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.
 3. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.
- G. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 3. Locate piping in center of sleeve or penetration.
 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 5. Tighten bolting for a water-tight seal.
 6. Install in accordance with manufacturer's recommendations.
- H. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.02 CLEANING

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

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**SECTION 23 05 29 -
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment components for equipment, piping, and other HVAC/hydronic work.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.
- C. Section 23 05 48 - Vibration and Seismic Controls for HVAC.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping 2014 (Reapproved 2020).
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).
- F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- G. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position 2018.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- J. MFMA-4 - Metal Framing Standards Publication 2004.
- K. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.
- L. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.05 SUBMITTALS

- A. See Division 1, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
 - 1. Fiberglass Channel (Strut) Framing Systems: Include requirements for strength derating according to ambient temperature.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
 - 1. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.

1.06 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.
- D. Installer Qualifications for Field-Welding: As specified in Section 05 50 00.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 - 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

1. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
 - b. Ferguson Enterprises Inc: www.fnw.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - d. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
 - e. Folco, a division of Eaton Corporation: www.eaton.com.
 - f. Substitutions: See Section 01 66 00 - Product Delivery, Storage and Handling See Division 1.
 2. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 3. Comply with MFMA-4.
 4. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
 5. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch (2.66 mm).
 6. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 13/16 inch (21 mm) height.
- C. Fiberglass Channel (Strut) Framing Systems: Factory-fabricated continuous-slot fiberglass channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports. (For use in the Greenhouses only)
1. Channel Material: Use polyester resin or vinyl ester resin.
 2. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 1 inch (25 mm) height.
 3. Flammability: Fire retardant with NFPA 101, Class A flame spread index (maximum of 25) when tested in accordance with ASTM E84; self-extinguishing in accordance with ASTM D635.
- D. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch (13 mm) diameter.
 - b. Piping up to 1 inch (27 mm) nominal: 1/4 inch (6 mm) diameter.
 - c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch (10 mm) diameter.
- E. Steel Cable:
1. Manufacturers:
 - a. Ductmate Industries, Inc, a DMI Company; Clutcher Cable Hanging System: www.ductmate.com.
 - b. Substitutions: See Division 1.
 - c. Source Limitations: Furnish associated fittings, accessories, and hardware produced by a single manufacturer.
- F. Thermal Insulated Pipe Supports:
1. Manufacturers:
 - a. Buckaroos, Inc: www.buckaroos.com.
 - b. KB Enterprises: www.snappitz.com.
 2. General Construction and Requirements:
 - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
 - b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
 - c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch (12.7 mm to 762 mm) iron pipes.
 - d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
 3. PVC Jacket:

- a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
 - b. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
 - c. Maximum Service Temperature: 180 degrees F (82 degrees C).
 - d. Moisture Vapor Transmission: 0.0071 perm inch (0.0092 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
 - e. Thickness: 60 mil (1.524 mm).
 - f. Connections: Brush on welding adhesive.
 4. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.
 5. Products:
 - a. Buckaroos, Inc; CoolDry: www.buckaroos.com.
 - b. Substitutions: See Division 1.
- G. Pipe Supports:
 1. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
 - b. Ferguson Enterprises Inc: www.fnw.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - d. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
 - e. Folco, a division of Eaton Corporation: www.eaton.com.
 - f. Substitutions: See Division 1.
 - g. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 2. Liquid Temperatures Up To 122 degrees F (50 degrees C):
 - a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
 - b. Support From Below: MSS SP-58 Types 35 through 38.
 3. Operating Temperatures from 122 to 446 degrees F (50 to 230 degrees C):
 - a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.
- H. Pipe Stanchions: For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.
 1. Manufacturers:
 - a. Anvil International; H-Block: www.anvilintl.com.
 - b. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
 - c. Ferguson Enterprises Inc: www.fnw.com.
 - d. Thomas & Betts Corporation: www.tnb.com.
 - e. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
 - f. Folco, a division of Eaton Corporation: www.eaton.com.
 - g. Substitutions: See Division 1.
 - h. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
 3. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
- I. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
 1. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
 - b. Ferguson Enterprises Inc: www.fnw.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - d. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
 - e. Folco, a division of Eaton Corporation: www.eaton.com.

- f. Substitutions: See Division 1.
 - g. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 - 2. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
 - 3. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
- J. Riser Clamps:
 - 1. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
 - b. Ferguson Enterprises Inc: www.fnw.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - d. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
 - e. Folco, a division of Eaton Corporation: www.eaton.com.
 - f. Substitutions: See Division 1.
 - g. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 - 2. Provide copper plated clamps for copper tubing support.
 - 3. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
- K. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.
 - 1. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
 - b. Ferguson Enterprises Inc: www.fnw.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - d. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
 - e. Folco, a division of Eaton Corporation: www.eaton.com.
 - f. Substitutions: See Division 1.
 - g. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- L. Strut Clamps: Two-piece pipe clamp.
 - 1. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
 - b. Ferguson Enterprises Inc: www.fnw.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - d. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
 - e. Folco, a division of Eaton Corporation: www.eaton.com.
 - f. Substitutions: See Division 1.
 - g. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- M. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.
 - 1. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
 - b. Ferguson Enterprises Inc: www.fnw.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - d. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
 - e. Folco, a division of Eaton Corporation: www.eaton.com.
 - f. Substitutions: See Division 1.
 - g. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- N. Pipe Hangers: For a given pipe run, use hangers of the same type and material.
 - 1. Manufacturers:

- a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
 - b. Ferguson Enterprises Inc: www.fnw.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - d. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
 - e. Folco, a division of Eaton Corporation: www.eaton.com.
 - f. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
 3. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
- O. Nonmetallic Pipe Hangers:
1. Manufacturers:
 - a. DecoShield Systems, Inc; Snap-2 Hangers: www.decoshield.com.
 - b. Substitutions: See Division 1.
- P. Intermediate Pipe Guides: Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.
1. Manufacturers:
 - a. Anvil International: www.anvilintl.com.
 - b. Substitutions: See Division 1.
 - c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 2. Pipe Diameter 6 inches (150 mm) and Smaller: Provide minimum clearance of 0.16 inch (4 mm).
- Q. Pipe Alignment Guides: Galvanized steel.
1. Manufacturers:
 - a. Anvil International: www.anvilintl.com.
 - b. Substitutions: See Division 1.
 - c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 2. Pipe Diameter 8 inches (200 mm) and Smaller: Spider or sleeve type.
 3. Pipe Diameter 10 inches (250 mm) and Larger: Roller type.
- R. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
- S. Pipe Shields for Insulated Piping:
1. Manufacturers:
 - a. Anvil International: www.anvilintl.com.
 2. General Construction and Requirements:
 - a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
 - b. Shields Material: UV-resistant polypropylene with glass fill.
 - c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch (321 mm).
 - d. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
 - e. Maximum Service Temperature: 178 degrees F (81 degrees C).
 - f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
- T. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
 - a. Hilti, Inc: www.us.hilti.com.
 - b. Substitutions: See Division 1.
 2. Manufacturers - Powder-Actuated Fastening Systems:
 - a. Hilti, Inc: www.us.hilti.com.

- b. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com.
 - c. Powers Fasteners, Inc: www.powers.com.
 - d. Simpson Strong-Tie Company Inc: www.strongtie.com.
 - 3. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
 - 4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 - 5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
 - 6. Hollow Masonry: Use toggle bolts.
 - 7. Hollow Stud Walls: Use toggle bolts.
 - 8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
 - 9. Sheet Metal: Use sheet metal screws.
 - 10. Wood: Use wood screws.
 - 11. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.
 - c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
- U. Pipe Installation Accessories:
 - 1. Copper Pipe Supports:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com.
 - 2) Substitutions: See Division 1.
 - 3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.
 - 2. Thermal Insulated Pipe Supports:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com.
 - 2) Substitutions: See Division 1.
 - 3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.
 - 3. Inserts and Clamps:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com.
 - 2) Substitutions: See Division 1.
 - 3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Identify and coordinate all grade beam penetrations with the Structural Engineer
- H. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- I. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 30 00.
 - 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- J. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
- K. Secure fasteners according to manufacturer's recommended torque settings.
- L. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 45 00 - Quality Control, for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

**SECTION 23 05 48 -
VIBRATION AND SEISMIC CONTROLS FOR HVAC**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Seismic control requirements.
- C. Vibration isolators.
- D. External seismic snubber assemblies.
- E. Seismic restraint systems.
- F. Vibration-isolated and/or seismically engineered roof curbs.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.03 REFERENCE STANDARDS

- A. ASCE 19 - Structural Applications of Steel Cables for Buildings 2016.
- B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.
- C. MFMA-4 - Metal Framing Standards Publication 2004.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Seismic Controls:
 - a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
 - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 - 1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
 - 2. Seismic Controls: Include seismic load capacities.
- C. Shop Drawings - Vibration Isolation Systems:
 - 1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.

2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.
- D. Shop Drawings - Seismic Controls:
 1. Include dimensioned plan views and sections indicating proposed HVAC component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
 2. Identify mounting conditions required for equipment seismic qualification.
 3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
 4. Indicate proposed arrangement of distributed system trapeze support groupings.
 5. Indicate proposed locations for distributed system flexible fittings and/or connections.
 6. Indicate locations of seismic separations where applicable.
 7. Include point load drawings indicating design loads transmitted to structure at each attachment location.
- E. Manufacturer's detailed field testing and inspection procedures.
- F. Field quality control test reports.

1.06 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 1. Select vibration isolators to provide required static deflection.
 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
 3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
 4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
 5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch (50 mm) operating clearance beneath base unless otherwise indicated.
- D. Equipment Isolation: As indicated on drawings.

2.02 VIBRATION ISOLATORS

- A. Manufacturers:
 1. Vibration Isolators:
 - a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
 - b. Mason Industries: www.mason-ind.com/#sle.
 - c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
 - d. Substitutions: See Division 1.
- B. General Requirements:
 1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
 2. Spring Elements for Spring Isolators:

- a. Color code or otherwise identify springs to indicate load capacity.
 - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
 - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
 - d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
 - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
 - f. Selected to function without undue stress or overloading.
- C. Vibration Isolators for Nonseismic Applications:
1. Resilient Material Isolator Pads:
 - a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
 - b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch (6 mm) thickness.
 - c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
 2. Housed Spring Isolators:
 - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
 - b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
 - c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
 - d. Furnished with integral leveling device for positioning and securing supported equipment.

2.03 SEISMIC RESTRAINT SYSTEMS

- A. Manufacturers:
1. Seismic Restraint Systems:
 - a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
 - b. Eaton Corporation: www.eaton.com/#sle.
 - c. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
 - d. Mason Industries: www.mason-ind.com/#sle.
- B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.
- C. Cable Restraints:
1. Comply with ASCE 19.
 2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
 3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
 4. Use protective thimbles for cable loops where potential for cable damage exists.
- D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 CODE-REQUIRED SPECIAL INSPECTIONS

- A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 45 33 and statement of special inspections as required by applicable building code.
- B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
 - 1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
- C. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.
- D. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Field-Welding (where approved by Architect): Comply with Section 05 50 00.
- E. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- F. Vibration Isolation Systems:
 - 1. Vibration-Isolated Equipment Support Bases:
 - a. Provide specified minimum clearance beneath base.
 - 2. Spring Isolators:
 - a. Position equipment at operating height; provide temporary blocking as required.
 - b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
 - c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
 - 3. Isolator Hangers:
 - a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
 - b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
 - 4. Thrust Restraints:
 - a. Adjust restraint movement under normal operating static pressure.
 - 5. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 - 6. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
 - 7. Adjust isolators to be free of isolation short circuits during normal operation.
 - 8. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.
- G. Seismic Controls:

1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch (3 mm), use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch (3 mm) or less.
4. Equipment with Sheet Metal Housings:
 - a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
 - b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
 - c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
5. Concrete Housekeeping Pads:
 - a. Size in accordance with seismic design to meet anchor requirements.
 - b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
6. Seismic Restraint Systems:
 - a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
 - b. Install restraints within permissible angles in accordance with seismic design.
 - c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
 - d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
 - e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.04 FIELD QUALITY CONTROL

- A. See Section See Division 1, for additional requirements.
- B. Inspect vibration isolation and/or seismic control components for damage and defects.
- C. Provide manufacturer representative or authorized technician services to assist with inspection and testing of vibration isolation systems and seismic controls. Submit a detailed copy of manufacturer recommended inspection, testing, and field report procedures.
- D. Vibration Isolation Systems:
 1. Verify isolator static deflections.
 2. Verify required clearance beneath vibration-isolated equipment support bases.
 3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
- E. Seismic Controls:
 1. Verify snubbing element air gaps.
- F. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.
- G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.05 ATTACHMENTS

- A. Statement of special inspections.

END OF SECTION

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**SECTION 23 05 53 -
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Adhesive-backed duct markers.
- D. Stencils.
- E. Pipe markers.

1.02 RELATED REQUIREMENTS

- A. Section 09 90 00 - Painting: Identification painting.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- C. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Automatic Controls: Tags. Key to control schematic.
- C. Control Panels: Nameplates.
- D. Ductwork: Nameplates.
- E. Heat Transfer Equipment: Nameplates.
- F. Piping: Tags.
- G. Small-sized Equipment: Tags.
- H. Thermostats: Nameplates.
- I. Water Meters: Nameplates.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com.
 - 2. Brimar Industries, Inc: www.pipemarker.com.
 - 3. Craftmark Pipe Markers: www.craftmarkid.com.
 - 4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
 - 5. Seton Identification Products, a Tricor Direct Company: www.seton.com.
 - 6. Substitutions: See Division 1..
- B. Letter Color: White.
- C. Letter Height: 1/4 inch (6 mm).
- D. Background Color: Black.

2.03 TAGS

- A. Manufacturers:
 - 1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
 - 2. Brady Corporation: www.bradycorp.com.
 - 3. Brimar Industries, Inc: www.pipemarker.com.
 - 4. Craftmark Pipe Markers: www.craftmarkid.com.

5. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
6. Seton Identification Products, a Tricor Company: www.seton.com.
7. Substitutions: See Section 01 66 00 - Product Delivery, Storage and Handling See Division 1.

2.04 ADHESIVE-BACKED DUCT MARKERS

- A. Manufacturers:
 1. Brimar Industries, Inc: www.pipemarker.com.
 2. Craftmark Pipe Markers: www.craftmarkid.com.
 3. Substitutions: See Division 1.
- B. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch (0.76 mm); printed with UV and chemical resistant inks.
- C. Style: Individual Label.
- D. Color: Yellow/Black.

2.05 STENCILS

- A. Manufacturers:
 1. Brady Corporation: www.bradycorp.com.
 2. Craftmark Pipe Markers: www.craftmarkid.com.
 3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
 4. Seton Identification Products, a Tricor Company: www.seton.com.
 5. Substitutions: See Division 1.
- B. Stencils: With clean cut symbols and letters of following size:
 1. 3/4 to 1-1/4 inch (20-30 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 1/2 inch (15 mm) high letters.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Apply stencil painting in accordance with Section 09 90 00.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.
- G. Use tags on piping 3/4 inch (20 mm) diameter and smaller.
 1. Identify service, flow direction, and pressure.
 2. Install in clear view and align with axis of piping.
- H. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- I. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

**SECTION 23 05 93 -
TESTING, ADJUSTING, AND BALANCING FOR HVAC**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.
- C. Sound measurement of equipment operating conditions.
- D. Commissioning activities.

1.02 RELATED REQUIREMENTS

- A. Section 01 91 00 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

1.03 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008, with Errata (2019).
- C. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Submit to Architect.
 - 2. Submit to the Commissioning Authority.
 - 3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
 - 4. Include at least the following in the plan:
 - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - d. Final test report forms to be used.
 - e. Detailed step-by-step procedures for TAB work for each system and issue, including:
 - 1) Terminal flow calibration (for each terminal type).
 - 2) Diffuser proportioning.
 - 3) Branch/submain proportioning.
 - 4) Total flow calculations.
 - 5) Rechecking.
 - 6) Diversity issues.
 - f. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.
 - g. Confirmation of understanding of the outside air ventilation criteria under all conditions.
 - h. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).

- i. Method of checking building static and exhaust fan and/or relief damper capacity.
 - j. Proposed selection points for sound measurements and sound measurement methods.
 - k. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
 - l. Procedures for formal deficiency reports, including scope, frequency and distribution.
- D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.
- E. Progress Reports.
- F. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 1. Submit to the the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
 2. Revise TAB plan to reflect actual procedures and submit as part of final report.
 3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 6. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
 7. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Project Architect.
 - g. Project Engineer.
 - h. Project Contractor.
 - i. Project altitude.
 - j. Report date.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 1. AABC (NSTSB), AABC National Standards for Total System Balance.
 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
 3. SMACNA (TAB).
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- D. TAB Agency Qualifications:
 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

2. Having minimum of three years documented experience.
3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
 - b. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.
- E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 1. Systems are started and operating in a safe and normal condition.
 2. Temperature control systems are installed complete and operable.
 3. Proper thermal overload protection is in place for electrical equipment.
 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 5. Duct systems are clean of debris.
 6. Fans are rotating correctly.
 7. Fire and volume dampers are in place and open.
 8. Air coil fins are cleaned and combed.
 9. Access doors are closed and duct end caps are in place.
 10. Air outlets are installed and connected.
 11. Duct system leakage is minimized.
 12. Hydronic systems are flushed, filled, and vented.
 13. Pumps are rotating correctly.
 14. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

- A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
- B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.
- C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.06 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.
- M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

3.07 COMMISSIONING

- A. See Sections See Division 1 for additional requirements.
- B. Perform prerequisites prior to starting commissioning activities.
- C. Fill out Prefunctional Checklists for:
 - 1. Air side systems.
 - 2. Water side systems.
- D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.
- E. Re-check a random sample equivalent to percent of the final TAB report data as directed by Commissioning Authority.
 - 1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
 - 2. Use the same test instruments as used in the original TAB work.
 - 3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
 - 4. For purposes of re-check, failure is defined as follows:
 - a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.

- b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
- c. Temperatures: Deviation of more than one degree F (0.5 degree C).
- d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
- e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
- 5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.
- F. In the presence of the Commissioning Authority, verify that:
 - 1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
 - 2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
 - 3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.08 SCOPE

- A. Test, adjust, and balance the following:
 - 1. Air Source Heat Pumps.
 - 2. Air Handling Units & Fancoils.
 - 3. Exhaust or Supply Fans.
 - 4. Air Filters.
 - 5. Air Inlets and Outlets.

3.09 MINIMUM DATA TO BE REPORTED

- A. Air Cooled Condensers:
 - 1. Identification/number.
 - 2. Location.
 - 3. Manufacturer.
 - 4. Model number.
 - 5. Serial number.
 - 6. Entering DB air temperature, design and actual.
 - 7. Leaving DB air temperature, design and actual.
- B. Air Moving Equipment:
 - 1. Location.
 - 2. Manufacturer.
 - 3. Model number.
 - 4. Serial number.
 - 5. Arrangement/Class/Discharge.
 - 6. Air flow, specified and actual.
 - 7. Return air flow, specified and actual.
 - 8. Outside air flow, specified and actual.
 - 9. Total static pressure (total external), specified and actual.

10. Fan RPM.
- C. Return Air/Outside Air:
 1. Identification/location.
 2. Design air flow.
 3. Actual air flow.
- D. Exhaust Fans:
 1. Location.
 2. Manufacturer.
 3. Model number.
 4. Serial number.
 5. Air flow, specified and actual.
 6. Total static pressure (total external), specified and actual.
- E. Duct Traverses:
 1. System zone/branch.
 2. Duct size.
 3. Area.
 4. Design velocity.
 5. Design air flow.
 6. Test velocity.
 7. Test air flow.
 8. Duct static pressure.
 9. Air temperature.
- F. Sound Level Reports:
 1. Location.
 2. Octave bands - equipment off.
 3. Octave bands - equipment on.

END OF SECTION

SECTION 23 07 13 - DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Duct liner.
- C. Insulation jackets.

1.02 RELATED REQUIREMENTS

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 07 84 00 - Firestopping.
- C. Section 09 90 00 - Painting: Painting insulation jackets.
- D. Section 23 05 53 - Identification for HVAC Piping and Equipment.

1.03 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- E. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation 2020.
- F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material) 2019.
- G. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings 2019.
- H. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers 2015.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
- L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Division 1, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
 - 1. CertainTeed Corporation: www.certainteed.com.
 - 2. Johns Manville: www.jm.com.
 - 3. JP Lamborn Co; Thermal Sleeve MT: www.jpflex.com.
 - 4. Knauf Insulation; Atmosphere Duct Wrap: www.knaufinsulation.com.
 - 5. Owens Corning Corporation: www.ocbuildingspec.com.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. K (Ksi) value: 0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 1200 degrees F (649 degrees C).
 - 3. Maximum Water Vapor Absorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
 - 3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
 - 1. Manufacturers:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90..
 - b. Vimasco Corporation; 749.
- E. Indoor Vapor Barrier Mastic:
 - 1. Manufacturers:
 - a. Design Polymeric; DP 3040 Water Based, Zero VOC, Premium Quality, Low Perm, Vapor Barrier Coating: www.designpoly.com.

2.03 JACKETS

- A. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square (2.45 kg/sq m).
- B. Aluminum Jacket: ASTM B209 (ASTM B209M).
 - 1. Thickness: 0.016 inch (0.40 mm) sheet.
 - 2. Finish: Smooth.
 - 3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
 - 4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.

5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.
6. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.
- C. Flexible Weather-Proofing Outdoor Jacket: Self-healing, field-applied outdoor cladding.
 1. Material: Aluminum foil/polymer laminate with rubberized asphalt layer and acrylic adhesive.
 2. Thickness: 34 mils (0.86 mm).
 3. Finish: Embossed.
 4. Color: Silver.
 5. Water Vapor Transmission: 0.002 perm inch (0.0029 ng/Pa s m), maximum, when tested in accordance with ASTM E96/E96M.
 6. Mold Resistance: Pass when tested in accordance with ASTM C1338.
 7. Emissivity: 0.30 when tested in accordance with ASTM C1371.
 8. Manufacturers:
 - a. Polyguard Products; Alumaguard: www.polyguardproducts.com.com.

2.04 DUCT LINER

- A. Manufacturers:
 1. CertainTeed Corporation: www.certainteed.com.
 2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com.
 3. Johns Manville: www.jm.com.
 4. Knauf Insulation: www.knaufinsulation.com.
 5. Owens Corning Corporation: www.ocbuildingspec.com.
- B. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
 1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F (0.045 at 24 degrees C).
 2. Service Temperature: Up to 250 degrees F (121 degrees C).
 3. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm (25.4 m/s), minimum.
- C. Adhesive: Waterproof, fire-retardant type, ASTM C916.
 1. Manufacturers:
 - a. Design Polymerics; DP 2502 Water Based, Low VOC, Duct Liner Adhesive: www.designpoly.com.
- D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated Ducts Conveying Air Below Ambient Temperature:
 1. Provide insulation with vapor barrier jackets.
 2. Finish with tape and vapor barrier jacket.
 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. Insulated Ducts Conveying Air Above Ambient Temperature:
 1. Provide with or without standard vapor barrier jacket.

2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- E. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with aluminum sheet metal insulation shield. Indoor unconditioned spaces or covered areas that are subject to outside temperatures are considered exterior applications (crawlspaces, etc.).
- F. Slope exterior ductwork to shed water.
- G. External Duct Insulation Application:
 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 2. Secure insulation without vapor barrier with staples, tape, or wires.
 3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- H. Duct and Plenum Liner Application:
 1. Adhere insulation with adhesive for 90 percent coverage.
 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
 3. Seal and smooth joints. Seal and coat transverse joints.
 4. Seal liner surface penetrations with adhesive.
 5. Duct dimensions indicated are net inside dimensions required for air-flow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

- A. Evaporative Condenser Intake and Exhaust:
- B. Exhaust Ducts Within 10 ft (3 m) of Exterior Openings:
- C. Exhaust Ducts Exposed to Outdoor Air:
- D. Outside Air Intake Ducts:
- E. Plenums:
- F. Plenums (Cooling System):
- G. Ventilation Equipment Casings:
- H. Supply Ducts:
- I. Supply Ducts From Fans to Vertical Ducts in Shafts (Cooling System):
- J. Supply Ducts in Vertical Shafts (Cooling Systems):
- K. Supply ducts After Terminal Boxes:
- L. Return and Relief Ducts in Mechanical Rooms:
- M. Ducts Exposed to Outdoors:

END OF SECTION

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Flexible removable and reusable blanket insulation.
- C. Jackets and accessories.
- D. Engineered wall outlet seals and refrigerant piping insulation protection.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 23 81 29 - Variable Refrigerant Flow HVAC Systems

1.03 REFERENCE STANDARDS

- A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2019.
- B. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
- C. ASTM D610 - Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces 2008 (Reapproved 2019).
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Division 1, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

1.06 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 JACKETS

- A. PVC Plastic.
 - 1. Manufacturers:
 - a. Johns Manville Corporation: www.jm.com/#sle.
 - 2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F (minus 18 degrees C).

- b. Maximum Service Temperature: 150 degrees F (66 degrees C).
- c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/Pa s m), maximum, when tested in accordance with ASTM E96/E96M.
- d. Thickness: 10 mil (0.25 mm).
- e. Connections: Brush on welding adhesive.

2.03 ENGINEERED WALL OUTLET SEALS AND REFRIGERANT PIPING INSULATION PROTECTION

- A. Manufacturers:
 - 1. Airex Manufacturing, Inc: www.airexmfg.com/.
 - 2. Substitutions: See Division 1.
- B. Basis of Design: Airex Manufacturing, Inc; www.airexmfg.com.
 - 1. Pipe Penetration Wall Seal: Airex Titan Outlet.
 - 2. Refrigeration Pipe Insulation Protection System: Airex E-Flex Guard.
 - 3. Pipe Penetration Wall Seal and Insulation Protection System: Airex Pro-System Kit.
- C. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.
 - 1. Outlet Cover Color: Gray.
- D. Insulation Protection System: Refrigerant piping insulation PVC protective cover.
 - 1. PVC Insulation Cover Color: Black with full-length velcro fastener.
 - 2. Flame Spread and Smoke Development Rating of 24/450: Comply with ASTM E84 or UL 723.

2.04 ACCESSORIES

- A. General Requirements:
 - 1. Provide required accessories in accordance with and subject to the recommendations of the insulation manufacturer.
 - 2. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
 - 3. Comply with ASTM C795 requirements for materials to be used on stainless steel surfaces.
 - 4. Supply materials that are asbestos free.
- B. Corrosion Inhibitors:
 - 1. Corrosion Control Gel:
 - a. Corrosion Protection: Comply with ASTM B117 and ASTM D610.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated Pipes Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward

- clinch expanding staples and vapor barrier mastic.
- 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.
- H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with canvas jacket sized for finish painting.

3.03 SCHEDULE

- A. Cooling Systems:
 - 1. Cold Condensate Drains:
 - 2. Condensate Drains from Cooling Coils:
 - 3. Refrigerant Suction:
 - 4. Refrigerant Hot Gas:

END OF SECTION

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**SECTION 23 09 93 -
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.
- B. Sequence of operation for:
 - 1. Air Source Heat Pumps
 - 2. Data Room H405
 - 3. Electrical room H406.
 - 4. Exhaust Fans
 - 5. Water Flow Meters

1.02 RELATED REQUIREMENTS

- A. Section 01 91 00 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.
 - 1. Preface: 1 or 2 paragraph overview narrative of the system describing its purpose, components and function.
 - 2. State each sequence in small segments and give each segment a unique number for referencing in Functional Test procedures; provide a complete description regardless of the completeness and clarity of the sequences specified in Contract Documents.
 - 3. Include at least the following sequences:
 - a. Start-up.
 - b. Warm-up & pull-down modes.
 - c. Normal operating mode.
 - d. Unoccupied mode.
 - e. Shutdown.
 - f. Capacity control sequences and equipment staging.
 - g. Temperature and pressure control, such as setbacks, setups, resets, etc.
 - h. Detailed sequences for all control strategies, such as economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
 - i. Sequences for all alarms and emergency shut downs.
 - j. Seasonal operational differences and recommendations.
 - k. Interactions and interlocks with other systems.
 - 4. Include initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
 - 5. For packaged controlled equipment, include manufacturer's furnished sequence of operation amplified as required to describe the relationship between the packaged controls and the control system, indicating which points are adjustable control points and which points are only monitored.
 - 6. Include schedules, if known.
- C. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
 - 1. Label with settings, adjustable range of control and limits.

2. Include the system and component layout of all equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
 3. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
 4. Include all monitoring, control and virtual points specified in elsewhere.
 5. Include a key to all abbreviations.
- D. Points List: Submit list of all control points indicating at least the following for each point.
1. Name of controlled system.
 2. Point abbreviation.
 3. Point description; such as dry bulb temperature, airflow, etc.
 4. Display unit.
 5. Control point or setpoint (Yes / No); i.e. a point that controls equipment and can have its setpoint changed.
 6. Monitoring point (Yes / No); i.e. a point that does not control or contribute to the control of equipment but is used for operation, maintenance, or performance verification.
 7. Intermediate point (Yes / No); i.e. a point whose value is used to make a calculation which then controls equipment, such as space temperatures that are averaged to a virtual point to control reset.
 8. Calculated point (Yes / No); i.e. a "virtual" soft point generated from calculations of other point values.
- E. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

1.04 QUALITY ASSURANCE

- A. Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed at the State in which the Project is located.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 AIR SOURCE HEAT PUMPS

- A. Architecture Approach: Most VRV/VRF systems, including the BOD manufacturer Daikin, are designed to operate most efficiently with their own proprietary local controllers, and offering central control for many of the key variables while maintaining algorithms optimized for condenser and fancoil control within their local controllers. This ASHP section is written starting with the assumption that the manufacturer's local controller & thermostats are used, relying on those predefined algorithms to give the specific speed and capacity commands for the condensers and fancoils. We, therefore, focus primarily on the central controls sequences & variables/points in the following paragraphs. Because the integration of a VRV/VRF manufacturer's local controls and a third party's DDC controls system will be unique for each project, we encourage the winning bidder to propose any specific improvements in the owner's experience or overall value from the way the two systems are integrated. A general use allocation of points has been indicated in the points list and is intended to be used to pick up owner requests for integrating additional points/variables identified after project award by the owner and/or the Engineer Of Record (EOR).
- B. Run Conditions - Scheduled: The unit shall run according to a user-definable time schedule in the following modes:
- C. Occupied Mode: The unit shall maintain
1. A 78°F (adj.) cooling setpoint
 2. A 70°F (adj.) heating setpoint
- D. Unoccupied Mode (night setback): The unit shall maintain
1. A 85°F (adj.) cooling setpoint.
 2. A 55°F (adj.) heating setpoint.

- E. Alarms shall be provided as follows:
 - 1. High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user-definable amount (adj.).
 - 2. Low Zone Temp: If the zone temperature is less than the heating setpoint by a user-definable amount (adj.).
- F. Zone Setpoint Adjust: The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.
- G. Zone Optimal Start: The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of the scheduled occupied period.
- H. Zone Unoccupied Override: A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.
- I. Fan: The fan shall run anytime the unit is commanded to run, unless shutdown on safeties. The fan speeds shall be run at the lowest speeds deemed necessary to maintain the space setpoints using the algorithms preconfigured within the manufacturer's fancoil controller. When economizer cooling is enabled, the fan shall ramp up as needed to maximize economizer cooling opportunities before enabling direct cooling.
- J. Heating and Cooling - Compressor: The condensers compressors shall be cycled on/off by the manufacturer's compressor controller to maintain zone temperature and where variable speed, shall vary the compressors speed to maintain space setpoint in collaboration with the variable fan speed fancoils. The compressor shall run subject to its own internal safeties and controls.
- K. The heating mode shall be enabled whenever:
 - 1. Outside air temperature is less than 65°F (adj.).
 - 2. AND the fan status is on.
- L. AND the reversing valve is in heat mode.
- M. The cooling shall be enabled whenever:
 - 1. Outside air temperature is greater than 60°F (adj.).
 - 2. AND the fan status is on.
 - 3. AND the reversing valve is in cool mode.
- N. On mode change, the compressor shall be disabled and remain off until after the reversing valve has changed position.
- O. Economizer: (Class Lab Fancoils only)
The controller shall measure the zone temperature and modulate the mixed air dampers in sequence to maintain the zone cooling setpoint. The outside air damper shall maintain a minimum air adjustable position (adj.) open whenever occupied. The minimum air damper position shall be determined by coordinating measured airflows in the field by the TAB provider. Refer to the project T-24 compliance forms and the equipment schedules, for the required minimum outside air flows for each unit. Use the larger of the two if the two sources differ.

The economizer shall be enabled whenever:
 - 1. Outside air temperature is at least 3°F (adj.) less than the zone temperature.
 - 2. AND the outside air temperature is less than 75°F (adj.)
- P. The economizer shall close whenever the unit is in the unoccupied mode, except where cooling is requested and the economizer is enabled based on temperatures to maintain the night setback temperature.

- Q. The outside air damper shall close and the return air damper shall open when the unit is off. If Optimal Start Up is available the mixed air damper shall operate as described in the occupied mode except that the outside air damper shall modulate to fully closed.
- R. Minimum Outside Air Ventilation - Carbon Dioxide (CO2) Control: (Class Labs only)
When in the occupied mode, the controller shall measure the zone CO2 concentration and open the outside air dampers on rising CO2 concentrations, overriding normal damper operation as CO2 concentrations rise above 750ppm (adj.).
- S. Shut Off and Temperature Setup/Setback (FC 5-1 only):
 - 1. When the occupancy sensors indicate that all of the spaces on a zone has been unpopulated for 5 minutes continuously during the occupied mode, the zone shall be set in "occupied standby mode". During the occupied standby mode, the active heating set point shall be decreased by 2°F and the cooling set point shall be increased by 2°F.
 - 2. During occupied standby mode, all airflow to the zone shall be shut off whenever the space is between the active heating and cooling setpoints, as adjusted above.
 - a. Shut off the fancoil serving this zone.
 - b. Shut off the OA damper.
- T. Fan Status: The controller shall monitor the fan status.
- U. Fan Status: The controller shall monitor the fan status.
- V. Alarms shall be provided as follows:
 - 1. Fan Failure: Commanded on, but the status is off.
 - 2. Fan in Hand: Commanded off, but the status is on.
 - 3. Fan Runtime Exceeded: Fan status runtime exceeds a user-definable limit (adj.).
- W. Zone Carbon Dioxide (CO2) Concentration Monitoring:
The controller shall measure the zone CO2 concentration.
- X. Alarms shall be provided as follows:
- Y. High Zone Carbon Dioxide Concentration: If the zone CO2 concentration is greater than 1000ppm (adj.) when in the occupied mode.

3.02 DATA ROOM H405

- A. Run Conditions - 24/7: The unit shall run 24 hours a day, 365 days a year.
- B. Adjust wall-mounted stand-alone thermostat to a room temperature setpoint of 80 degrees F.
- C. Provide wall-mounted temperature sensor for remote monitoring of room temperatures.
- D. On room temperatures above 90 degrees F (32 degrees C), signal alarm.

3.03 ELECTRICAL ROOM H406

- A. Run Conditions - 24/7: The unit shall run 24 hours a day, 365 days a year.
- B. Adjust line-voltage thermostat to run fan at room temperatures above 85 degrees F.

3.04 EXHAUST FANS

- A. Run Conditions - Scheduled: The fan shall run according to a user-definable schedule.
- B. Fan: The fan shall have a user-definable (adj.) minimum runtime.
- C. Fan Status: The controller shall monitor the fan status.
- D. Alarms shall be provided as follows:
 - 1. Fan Failure: Commanded on, but the status is off.
 - 2. Fan in Hand: Commanded off, but the status is on.
 - 3. Fan Runtime Exceeded: Fan status runtime exceeds a user-definable limit (adj.).

3.05 WATER FLOW METERS

- A. Water Meter: The controller shall monitor the water meter for water consumption on a continual basis. These values shall be made available to the system at all times.
- B. Alarm shall be generated as follows:
 - 1. Invalid Reading: Sensor reading indicates an invalid value from the water meter (beyond the rated GPM for example).
- C. Peak Demand History: The controller shall monitor and record the peak (high and low) demand readings from the water meter. These readings shall be recorded on a daily, month-to-date, and year-to-date basis.
- D. Usage History: The controller shall monitor and record water meter readings so as to provide a water consumption history. Usage readings shall be recorded on a daily, month-to-date, and year-to-date basis.

END OF SECTION

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SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal ductwork.
- B. Nonmetal ductwork.
- C. Casings and plenums.
- D. Duct cleaning.

1.02 RELATED REQUIREMENTS

- A. Section 09 91 23 - Interior Painting: Weld priming, paint or coating.
- B. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.
- C. Section 23 07 13 - Duct Insulation: External insulation and duct liner.
- D. Section 23 33 00 - Air Duct Accessories.
- E. Section 23 37 00 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS

- A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- D. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements 2015.
- E. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements 2015.
- F. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements 2015.
- G. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.
- H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
- I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
- J. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual 2012.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for duct materials.
- C. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meet or exceed specified requirements.
- D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK).
- E. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.06 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

- A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.
- B. Ducts: Galvanized steel, unless otherwise indicated.
- C. Low Pressure Supply (Heating Systems): 1 inch w.g. (250 Pa) pressure class, galvanized steel.
- D. Low Pressure Supply (System with Cooling Coils): 1 inch w.g. (250 Pa) pressure class, galvanized steel.
- E. Return and Relief: 1 inch w.g. (250 Pa) pressure class, galvanized steel.
- F. General Exhaust: 1 inch w.g. (250 Pa) pressure class, galvanized steel.
- G. Outside Air Intake: 1/2 inch wg (125 Pa) pressure class, galvanized steel.
- H. Transfer Air and Sound Boots: 1 inch w.g. (250 Pa) pressure class, galvanized steel with 1" acoustical lining.

2.02 MATERIALS

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
- C. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
 - 1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
 - 2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
 - 3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
 - 4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
 - 5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
 - 6. Manufacturers:
 - a. Powers Fasteners, Inc: www.powers.com.

2.03 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
- B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.
- C. Duct systems have been designed for metal duct. At the Contractor's option, fibrous glass duct may be substituted for metal duct.
- D. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
- E. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
- F. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

- G. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- H. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).
- I. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

- A. Round Ducts: Round lockseam duct with galvanized steel outer wall.
 - 1. Manufacture in accordance with SMACNA (DCS).
 - 2. Manufacturers:
 - a. EHG, a DMI Company: www.ehgduct.com.
 - b. Linx Industries, Inc, a DMI Company: www.li-hvac.com.
 - c. MKT Metal Manufacturing: www.mktduct.com.
- B. Flexible Ducts: Black or grey polymer film supported by helically wound spring steel wire.
 - 1. UL labeled.
 - 2. Insulation: Fiberglass insulation with aluminized vapor barrier film.
 - 3. Pressure Rating: 4 inches wg (1000 Pa) positive and 0.5 inches wg (175 Pa) negative.
 - 4. Maximum Velocity: 4000 fpm (20.3 m/sec).
 - 5. Temperature Range: Minus 20 degrees F to 175 degrees F (Minus 28 degrees C to 79 degrees C).
 - 6. Manufacturers:
 - a. Hart & Cooley, Inc: www.hartandcooley.com.
 - b. Thermaflex MK-E: www.thermaflex.net.
 - c. Substitutions: See Division 1.
- C. Round Duct Connection System: Interlocking duct connection system in accordance with SMACNA (DCS).
 - 1. Manufacturers:
 - a. Ductmate Industries, Inc, a DMI Company: www.ductmate.com.
 - b. Substitutions: See Division 1.

2.05 CASINGS AND PLENUMS

- A. Fabricate casings in accordance with SMACNA (DCS) and construct for operating pressures indicated.
- B. Mount floor mounted casings on 4 inch (100 mm) high concrete curbs. At floor, rivet panels on 8 inch (200 mm) centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18 gauge, 0.0478 inch (1.21 mm) expanded metal mesh supported at 12 inch (300 mm) centers, turned up 12 inches (300 mm) at sides with sheet metal shields.
- C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.
- D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gauge, 0.0598 inch (1.52 mm) sheet steel back facing and 22 gauge, 0.0299 inch (0.76 mm) perforated sheet steel front facing with 3/32 inch (2.4 mm) diameter holes on 5/32 inch (4 mm) centers. Construct panels 3 inches (75 mm) thick packed with 4.5 lb/cu ft (72 kg/cu m) minimum glass fiber insulation media, on inverted channels of 16 gauge, 0.0598 inch (1.52 mm) sheet steel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Flexible Ducts: Connect to metal ducts with adhesive.
- E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- H. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with crimp in direction of air flow.
- I. Use double nuts and lock washers on threaded rod supports.
- J. Connect terminal units to supply ducts directly or with one foot (300 mm) maximum length of flexible duct. Do not use flexible duct to change direction.
- K. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.
- L. Set plenum doors 6 to 12 inches (150 to 300 mm) above floor. Arrange door swings so that fan static pressure holds door in closed position.
- M. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

3.02 CLEANING

- A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.
- B. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.
- C. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Duct access doors.
- D. Duct test holes.
- E. Flexible duct connectors.
- F. Volume control dampers.
- G. Low leakage (Class 1A) control dampers.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 48 - Vibration and Seismic Controls for HVAC.
- B. Section 23 31 00 - HVAC Ducts and Casings.
- C. Section 23 90 00 - Energy Management and Control System

1.03 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
- B. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2021.
- C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).

1.04 SUBMITTALS

- A. See Division 1, for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
- C. Project Record Drawings: Record actual locations of access doors and test holes.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Division 1, for additional provisions.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

- A. Manufacturers:
 - 1. Ruskin Company: www.ruskin.com.
 - 2. Titus HVAC, a brand of Johnson Controls: www.titus-hvac.com.
 - 3. Price Industries..
 - 4. Substitutions: See Division 1.

- B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 BACKDRAFT DAMPERS - METAL

- A. Manufacturers:
 - 1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com.
 - 2. Nailor Industries, Inc: www.nailor.com.
 - 3. Ruskin Company: www.ruskin.com.
 - 4. United Enertech: www.unitedenertech.com.
 - 5. Substitutions: See Division 1.
- B. Gravity Backdraft Dampers, Size 18 by 18 inches (450 by 450 mm) or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.03 DUCT ACCESS DOORS

- A. Manufacturers:
 - 1. Acudor Products Inc, a Division of Nelson Industrial Inc: www.acudor.com.
 - 2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com.
 - 3. Elgen Manufacturing, Inc: www.elgenmfg.com.
 - 4. Nailor Industries, Inc: www.nailor.com.
 - 5. Ruskin Company: www.ruskin.com.
 - 6. SEMCO LLC: www.semcohvac.com.
 - 7. Ward Industries, a brand of Hart and Cooley, Inc: www.wardind.com.
 - 8. Substitutions: See Division 1.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch (25 mm) thick insulation with sheet metal cover.
 - 1. Less Than 12 inches (300 mm) Square: Secure with sash locks.
 - 2. Up to 18 inches (450 mm) Square: Provide two hinges and two sash locks.
 - 3. Up to 24 by 48 inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.
 - 4. Larger Sizes: Provide an additional hinge.
- D. Access doors with sheet metal screw fasteners are not acceptable.

2.04 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.
 - 1. Manufacturers:
 - a. Carlisle HVAC Products; Dynair Test Port with Red Cap with O-Ring Seal: www.carlislehvac.com.
 - b. Substitutions: See Division 1.

2.05 FLEXIBLE DUCT CONNECTORS

- A. Manufacturers:
 - 1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com.
 - 2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com.
 - 3. Elgen Manufacturing, Inc: www.elgenmfg.com.
 - 4. Substitutions: See Division 1.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.

- C. Flexible Duct Connections: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd (1.0 kg/sq m).
 - 2. Metal: 3 inches (75 mm) wide, 24 gage, 0.0239 inch (0.61 mm) thick galvanized steel.
- D. Leaded Vinyl Sheet: Minimum 0.55 inch (14 mm) thick, 0.87 lbs per sq ft (4.2 kg/sq m), 10 dB attenuation in 10 to 10,000 Hz range.
- E. Maximum Installed Length: 14 inch (356 mm).

2.06 VOLUME CONTROL DAMPERS

- A. Products furnished per Section 25 35 23.
- B. Manufacturers:
 - 1. AireTechnologies, Inc, a DMI Company: www.airetechnologies.com.
 - 2. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com.
 - 3. MKT Metal Manufacturing: www.mktduct.com.
 - 4. Nailor Industries, Inc: www.nailor.com.
 - 5. NCA, a brand of Metal Industries Inc: www.ncamfg.com.
 - 6. Ruskin Company: www.ruskin.com.
 - 7. United Enertech: www.unitedenertech.com.
- C. Fabricate in accordance with SMACNA (DCS) and as indicated.
- D. Single Blade Dampers:
 - 1. Fabricate for duct sizes up to 6 by 30 inch (150 by 760 mm).
 - 2. Blade: 24 gage, 0.0239 inch (0.61 mm), minimum.
- E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch (200 by 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
 - 1. Blade: 18 gage, 0.0478 inch (1.21 mm), minimum.
- F. End Bearings: Except in round ducts 12 inches (300 mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
 - 1. Manufacturers:
 - a. Carlisle HVAC Products; Dynair End Bearing Leak Resistant Sets: www.carlislehvac.com.
 - b. Elgen Manufacturing Company, Inc; Snap-in Bushing: www.elgenmfg.com.
- G. Quadrants:
 - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 - 3. Manufacturers:
 - a. Carlisle HVAC Products; Dynair Double Shear Rattle Free Quadrants 1/2 inch: www.carlislehvac.com.
 - b. Substitutions: See Division 1.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 31 00 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 8 by 8 inch (200 by 200 mm) size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch (100 by 100 mm) for balancing dampers only. Review locations prior to fabrication.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. Demonstrate re-setting of fire dampers to Owner's representative.
- F. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- G. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
- H. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 34 00 - CEILING PROPELLER FANS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Ceiling propeller fans.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 48 - Vibration and Seismic Controls for HVAC.
- B. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connection.

1.03 REFERENCE STANDARDS

- A. UL 507 - Electric Fans Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Division 1, for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan power, CFM, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Manufacturer's Instructions: Indicate installation instructions.
- D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans to project site in manufacturer's original packaging.
- B. Store fans under cover and elevated above grade in a safe, dry location.

1.07 WARRANTY

- A. See Division 1, for additional warranty requirements.
- B. Provide two year manufacturer warranty for the fan motor.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 507.
- B. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 CEILING PROPELLER FANS

- A. Manufacturers:
 - 1. MinkaAire: www.minkagroup.net.
 - 2. Hunter Fan International: www.hunterfan.com.
 - 3. Big Ass Fan Company: www.bigassfans.com.
 - 4. Substitutions: See Division 1.
- B. Performance Ratings: refer to plans, varies by location
- C. Number of Fan Blades: refer to plans, varies by location.
- D. Fan Diameter: refer to plans, varies by location.
- E. Mounting Options: Ceiling.

- F. Direct Drive Fan:
 - 1. Statically and dynamically balanced.
 - 2. Motors:
 - a. Open drip-proof (ODP).
 - b. Heavy duty ball bearing type.
 - c. Mount on vibration isolators or resilient cradle mounts, out-of-airstream.
 - d. Fully accessible for maintenance.
- G. Shafts and Bearings:
 - 1. Fan Shaft:
 - a. Ground and polished steel with anti-corrosive coating.
 - b. First critical speed at least 25 percent over maximum cataloged operating speed.
 - 2. Bearings:
 - a. Permanently sealed or pillow block type.
 - b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
 - c. 100 percent factory tested.
- H. Accessories:
 - 1. Refer to drawings & other specification sections for any additional accessories not specified within this section.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure fan with cadmium plated steel lag screws to structure in compliance with ceiling fan mounting detail(s).
- C. Buildings equipped with ESFR sprinklers of any sprinklers, must comply with NFPA 13 and NFPA 72 guidelines.
- D. Ceiling-mounted Fans:
 - 1. Install fans with blades at elevations AFF indicated on plans. Provide custom rod lengths where needed to achieve this.

END OF SECTION

SECTION 23 34 23 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cabinet exhaust fans.
- B. Inline centrifugal fans.

1.02 RELATED REQUIREMENTS

- A. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- B. Section 23 33 00 - Air Duct Accessories: Backdraft dampers.
- C. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.
- B. AMCA 99 - Standards Handbook 2016.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans 2020.
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2014.
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- H. UL 705 - Power Ventilators Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Division 1, for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Manufacturer's Instructions: Indicate installation instructions.
- D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Division 1, for additional provisions.
 - 2. Extra Fan Belts: One set for each individual fan.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 FIELD CONDITIONS

- A. Permanent ventilators may not be used for ventilation during construction.
- B. Permanent ventilators may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Carnes, a division of Carnes Company Inc: www.carnes.com.

- B. Greenheck Fan Corporation: www.greenheck.com.
- C. Loren Cook Company: www.lorencook.com.
- D. PennBarry, Division of Air System Components: www.pennbarry.com.
- E. Twin City Fan & Blower: www.tcf.com.
- F. Substitutions: See Division 1.

2.02 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.
- B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
- D. Fabrication: Comply with AMCA 99.
- E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- G. Enclosed Safety Switches: Comply with NEMA 250.

2.03 CABINET EXHAUST FANS

- A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.
- C. Grille: Molded white plastic.
- D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.04 INLINE CENTRIFUGAL FANS

- A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.
- C. Sheaves (where direct drive not indicated): Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.
- C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.
- D. Hung Cabinet Fans:
 - 1. Install fans with resilient rubber or spring isolator mountings where indicated on mounting details and flexible electrical leads. Refer to Section 22 05 48.

2. Install flexible connections specified in Section 23 33 00 between fan and ductwork.
Ensure metal bands of connectors are parallel with minimum one inch (25 mm) flex
between ductwork and fan while running.
- E. Provide sheaves or speed controllers required for final air balance.
- F. Install backdraft dampers on the inlet to or from outside air.

END OF SECTION

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SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Diffusers:
 - 1. Architectural ceiling diffusers (TAG D).
- B. Registers/grilles:
 - 1. Heavy duty bar return grilles (TAG B).
 - 2. Wall supply grilles (TAG C).
 - 3. Wall exhaust and return register/grilles (TAG E).
 - 4. Aeroblade supply grilles (TAG F)
- C. Duct-mounted supply and return registers/louvers (TAG A).
- D. Door grilles.
- E. Louvers:
 - 1. Stationary wall louvers
 - 2. Combination louvers.

1.02 REFERENCE STANDARDS

- A. AHRI 880 (I-P) - Performance Rating of Air Terminals 2017.
- B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2015.
- C. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices 2021.
- D. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers 2015, with Editorial Revision (2018).
- E. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets 2006 (Reaffirmed 2021).
- F. ASHRAE Std 130 - Laboratory Methods of Testing Air Terminal Units 2016.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- H. UL 2518 - Standard for Safety Air Dispersion Systems Current Edition, Including All Revisions.
- I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.
- J. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
- K. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2018.
- L. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.
- M. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).

1.03 SUBMITTALS

- A. See Division 1, for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- C. Project Record Documents: Record actual locations of air outlets and inlets.

1.04 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

- B. Test and rate louver performance in accordance with AMCA 500-L.
- C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Price Industries: www.price-hvac.com.
- B. Ruskin Company: www.ruskin.com.
- C. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com.
- D. Substitutions: See Division 1.

2.02 DUCT-MOUNTED SUPPLY AND RETURN REGISTERS/LOUVERS (TAG A)

- A. Type: Duct-mounted, rectangular register for round-spiral duct with adjustable pivot-ended blades, end caps, built-in volume damper, and flanges to match the duct diameter.
Performance to match manufacturer's catalog data.
- B. Material: 22 gage, 0.0299 inch (0.76 mm).
 - 1. Provide crossing spiral fitting-body of matching duct diameter.
- C. Color: clear anodized finish (silver).

2.03 ARCHITECTURAL CEILING DIFFUSERS (TAG D)

- A. Type: Square plaque in front of curved, recessed frame providing 360° airflow pattern.
- B. Frame: Titus frame type 1, surface mount, or equivalent surface mounted frame with concealed fasteners.
- C. Construction: Made of steel plaque and frame with factory enamel finish.
- D. Color: As selected by Architect from manufacturer's standard range.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face (where indicated on plans).

2.04 AEROBLADE SUPPLY GRILLES (TAG F)

- A. Type: Streamlined and individually adjustable blades, 2 inch (50.8 mm) minimum depth, 2 inch (50.8 mm) maximum spacing with spring or other device to set blades, vertical face, double deflection.
- B. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille with two-way deflection.
- C. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket.
- D. Fabrication: Steel with 20 gage, 0.0359 inch (0.91 mm) minimum frames and 22 gage, 0.0299 inch (0.76 mm) minimum blades, steel and aluminum with 20 gage, 0.0359 inch (0.91 mm) minimum frame, or aluminum extrusions, with factory baked enamel finish.
- E. Color: To be selected by Architect from manufacturer's standard range.
- F. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face (where indicated on plans).

2.05 WALL SUPPLY GRILLES (TAG C)

- A. Type: Streamlined and individually adjustable blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing with spring or other device to set blades, horizontal face, double deflection.
- B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket.
- C. Fabrication: Steel with 20 gage, 0.0359 inch (0.91 mm) minimum frames and 22 gage, 0.0299 inch (0.76 mm) minimum blades, steel and aluminum with 20 gage, 0.0359 inch (0.91 mm) minimum frame, or aluminum extrusions, with factory baked enamel finish.

- D. Color: To be selected by Architect from manufacturer's standard range.
- E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face (where indicated on plans).

2.06 WALL EXHAUST AND RETURN REGISTERS/GRILLES (TAG E)

- A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with spring or other device to set blades, horizontal face.
- B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting.
- C. Fabrication: Steel frames and blades, with factory baked enamel finish.
- D. Color: To be selected by Architect from manufacturer's standard range.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.07 HEAVY DUTY BAR RETURN GRILLES (TAG B)

- A. Type: Fixed grilles of 1/2" spacing, 38° fixed deflection, blades parallel to long dimension.
- B. Fabrication: Heavy duty steel with factory baked enamel finish.
- C. Color: To be selected by Architect from manufacturer's standard range.
- D. Frame: 16 ga 1-1/4 inch (32 mm) margin with countersunk screw mounting.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face (where indicated on plans).

2.08 DOOR GRILLES

- A. Type: V-shaped louvers of 20 gage, 0.0359 inch (0.91 mm) thick steel, 1 inch (25 mm) deep on 1/2 inch (13 mm) centers.
- B. Frame: 20 gage, 0.0359 inch (0.91 mm) steel with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish.

2.09 STATIONARY WALL LOUVERS

- A. Type: 6 inch (150 mm) deep frame with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch (13 mm) square mesh screen or 1/8 in (3.1 mm) non corrosive mesh screen over; refer to drawing equipment schedule notes to determine which screen applies to each louver location.
- B. Fabrication: 12 gage, 0.1046 inch (2.66 mm) thick extruded aluminum thick galvanized steel welded assembly, with factory baked enamel finish.
- C. Color: To be selected by Architect from manufacturer's full range.
- D. Size: As indicated on the drawings.
- E. Mounting: Furnish with interior flat flange for installation.

2.10 COMBINATION LOUVERS

- A. Damper-combined, drainable louver:
- B. Size: As indicated on the drawings.
- C. Material: Extruded aluminum.
- D. Paint Finish and Color: To be selected by Architect from manufacturer's full range.
- E. Rust Inhibitor Coating: Standard.
- F. Sleeve or Flange: Provide duct sleeve where directly connected to duct or grille behind louver.
- G. Duct Transition Fitting: Provide duct sleeve where directly connected to duct or grille behind louver.
- H. Mounting: Furnish with interior flat flange for installation.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.
- C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- D. Install diffusers to ductwork with air tight connection.
- E. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- F. Paint ductwork visible behind air outlets and inlets matte black except where black acoustical lining is installed. Refer to Section 09 91 23.

3.02 AIR OUTLET AND INLET SCHEDULE

- A. Refer to mechanical equipment schedules (sheets M6.0X)

END OF SECTION

**SECTION 23 63 13-
AIR COOLED REFRIGERANT CONDENSERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured units.
- B. Casing.
- C. Condenser coils.
- D. Fans and motors.
- E. Controls.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Equipment bases.
- B. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- C. Section 23 05 48 - Vibration and Seismic Controls for HVAC.
- D. Section 23 23 00 - Refrigerant Piping.
- E. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2008, Including All Addenda.
- B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2019, with All Amendments and Errata.
- C. ASHRAE Std 20 - Methods of Laboratory Testing Remote Mechanical-Draft Air-Cooled Refrigerant Condensers 2019.
- D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- F. NEMA MG 1 - Motors and Generators 2018.
- G. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Division 1, for submittal procedures.
- B. Product Data: Provide rated capacities, weights, accessories, electrical requirements, and wiring diagrams.
- C. Shop Drawings: Indicate components, assembly, dimensions, weights and loading, required clearances, and location and size of field connections. Include schematic layouts showing condenser, refrigeration compressors, cooling coils, refrigerant piping and accessories required for complete system.
- D. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.
- E. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.
- F. Operation and Maintenance Data: Include start-up instructions, maintenance instructions, parts lists, controls, and accessories.
- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Division 1, for additional provisions.
 - 2. Extra Fan Belts: One set for each unit.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.
- B. Protect units on site from physical damage. Protect coils.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. DAIKIN, a part of Daikin North America LLC, a unit of Daikin Industries:
www.daikinac.com/content/
- B. Trane, a brand of Ingersoll Rand: www.trane.com.
- C. York International Corporation/Johnson Controls, Inc: www.york.com.
- D. Substitutions: See Division 1.

2.02 PERFORMANCE REQUIREMENTS

- A. Refer to equipment schedules on plans for rated capacities and other performance requirements.
- B. Electrical Characteristics:
 - 1. 208 volts, single phase, 60 Hz.
- C. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Section 26 05 83.

2.03 MANUFACTURED UNITS

- A. Provide packaged, factory assembled, pre-wired unit, suitable for outdoor use consisting of casing, condensing coil and fans, integral sub-cooling coil liquid accumulator.
- B. Construction and Ratings: In accordance with AHRI 210/240 and UL 207. Testing shall be in accordance with ASHRAE Std 20.
- C. Performance Ratings: Energy Efficient Rating (EER)/Coefficient of Performance (COP) not less than prescribed by 2016 T-24 Part 6 California Energy Conservation Code., in combination with compressor units.
- D. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2.04 CASING

- A. House components in welded steel frame with steel panels with weather resistant, baked enamel finish.
- B. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.
- C. Provide removable access doors or panels with quick fasteners.

2.05 CONDENSER COILS

- A. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 425 psig (2900 kPa), and vacuum dehydrate. Seal with

holding charge of nitrogen.

2.06 FANS AND MOTORS

- A. Side discharge direct driven propeller type condenser fans with fan guard on discharge, equipped with roller or ball bearings with grease fittings extended to outside of casing.
- B. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or 3 phase, with permanent lubricated ball bearings and built-in current and thermal overload protection; refer to Section 23 05 13.

2.07 CONTROLS

- A. Provide factory wired and mounted control panel, NEMA 250, containing fan motor starters, fan cycling thermostats, compressor interlock, and control transformer.
- B. Provide thermostat to cycle fan motors in response to outdoor ambient temperature.
- C. Refer to controls drawings for additional controls requirements including accessories, sensors and EMS tie-in.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide for connection to electrical service. Refer to Section 26 05 83.
- C. Install units on isolators where indicated on the associated mounting details on plans. Refer to Section 22 05 48.
- D. Provide connection to factory-sized refrigeration piping system. Refer to Section 23 23 00. Comply with ASHRAE Std 15.
- E. Provide cooling season start-up, winter season shut-down service, for first year of operation.
- F. Shut-down system if initial start-up and testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

END OF SECTION

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**SECTION 23 81 29 -
VARIABLE REFRIGERANT FLOW HVAC SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Variable refrigerant volume HVAC system includes:
 - 1. Outdoor/condensing unit(s).
 - 2. Indoor/evaporator units.
 - 3. Refrigerant piping.
 - 4. Control panels.
 - 5. Control wiring.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 83 - Wiring Connections: Power connections to equipment.

1.03 REFERENCE STANDARDS

- A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2008, Including All Addenda.
- B. ITS (DIR) - Directory of Listed Products current edition.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 1995 - Heating and Cooling Equipment Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Division 1, for submittal procedures.
- B. Submittals: For proposed substitute systems/products, as defined in PART 2, and alternate systems/products, as defined above, proposer shall submit all data described in this article, under the terms given for substitutions stated in PART 2.
- C. Product Data: Submit manufacturer's standard data sheets showing the following for each item of equipment, marked to correlate to equipment item markings indicated in Contract Documents:
 - 1. Outdoor/Central Units:
 - a. Refrigerant Type and Size of Charge.
 - b. Cooling Capacity: Btu/h (W).
 - c. Heating Capacity: Btu/h (W).
 - d. Cooling Input Power: Btu/h (kW).
 - e. Heating Input Power: Btu/h (kW).
 - f. Operating Temperature Range, Cooling and Heating.
 - g. Air Flow: Cubic feet per minute (Cubic meters per second).
 - h. Fan Curves.
 - i. External Static Pressure (ESP): Inches WG (Pa).
 - j. Sound Pressure Level: dB(A).
 - k. Electrical Data:
 - 1) Maximum Circuit Amps (MCA).
 - 2) Maximum Fuse Amps (MFA).
 - 3) Maximum Starting Current (MSC).
 - 4) Full Load Amps (FLA).
 - 5) Total Over Current Amps (TOCA).
 - 6) Fan Motor: HP (W).
 - l. Weight and Dimensions.
 - m. Maximum number of indoor units that can be served.
 - n. Maximum refrigerant piping run from outdoor/condenser unit to indoor/evaporator unit.

- o. Maximum height difference between outdoor/condenser unit to indoor/evaporator unit, both above and below.
 - p. Control Options.
 - 2. Indoor/Evaporator Units:
 - a. Cooling Capacity: Btu/h (W).
 - b. Heating Capacity: Btu/h (W).
 - c. Cooling Input Power: Btu/h (kW).
 - d. Heating Input Power: Btu/h (kW).
 - e. Air Flow: Cubic feet per minute (Cubic meters per second).
 - f. Fan Curves.
 - g. External Static Pressure (ESP): Inches WG (Pa).
 - h. Sound Pressure level: dB(A).
 - i. Electrical Data:
 - 1) Maximum Circuit Amps (MCA).
 - 2) Maximum Fuse Amps (MFA).
 - 3) Maximum Starting Current (MSC).
 - 4) Full Load Amps (FLA).
 - 5) Total Over Current Amps (TOCA).
 - 6) Fan Motor: HP (W).
 - j. Maximum Lift of Built-in Condensate Pump.
 - k. Weight and Dimensions.
 - l. Control Options.
 - 3. Control Panels: Complete description of options, control points, zones/groups.
- D. Shop Drawings: Installation drawings custom-made for this project; include as-designed HVAC layouts, locations of equipment items, refrigerant piping sizes and locations, condensate piping sizes and locations, remote sensing devices, control components, electrical connections, control wiring connections. Include:
 - 1. Detailed piping diagrams, with branch balancing devices.
 - 2. Condensate piping routing, size, and pump connections.
 - 3. Detailed power wiring diagrams.
 - 4. Detailed control wiring diagrams.
 - 5. Locations of required access through fixed construction.
 - 6. Drawings required by manufacturer.
- E. Design Data:
 - 1. Provide design calculations showing that system will achieve performance specified.
- F. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.
- G. Operating and Maintenance Data:
 - 1. Manufacturer's complete standard instructions for each unit of equipment and control panel.
 - 2. Custom-prepared system operation, troubleshooting, and maintenance instructions and recommendations.
 - 3. Identification of replaceable parts and local source of supply.
- H. Warranty: Executed warranty, made out in Owner's name.
- I. Specimen Warranty: Copy of manufacturer's warranties.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Company that has been manufacturing variable refrigerant volume heat pump equipment for at least 5 years.
 - 2. Company that provides system design software to installers.

- B. Installer Qualifications: Trained and approved by manufacturer of equipment.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle equipment and refrigerant piping according to manufacturer's recommendations.

1.07 WARRANTY

- A. Compressors: Provide manufacturer's warranty for six (6) years from date of installation. During the stated period, should any part fail due to defects in material and workmanship, it shall be repaired or replaced at the discretion of Daikin AC (Americas), Inc. according to Daikin's terms and conditions. All warranty service work shall be preformed by a Daikin factory trained service professional.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: The system design indicated in Contract Documents is based on equipment and system designed by Daikin AC; www.daikinac.com.
- B. Systems designed and manufactured by other manufacturers will be considered by Owner under the terms described for substitutions with the following exceptions:
1. Substitutions: See Division 1.
 2. Substitution requests will be considered only if received at least 10 days prior to the bid date.
 3. Substitution requests will be considered only if required submittal data is complete; see article SUBMITTALS above.
 4. Contractor (not equipment supplier) shall certify that the use of the substitute system and equipment will not require changes to other work or re-design by the Engineers or the Architect.
 5. Do not assume substitution has been accepted until formal written notice has been issued by Architect.

2.02 HVAC SYSTEM DESIGN

- A. System Operation: Heating and cooling, simultaneously.
1. Zoning: Provide capability for temperature control for each individual indoor/evaporator unit independently of all other units.
 2. Zoning: Provide heating/cooling selection for each individual indoor/evaporator unit independently of all other units.
 3. Provide a complete functional system that achieves the specified performance based on the specified design conditions and that is designed and constructed according to the equipment manufacturer's requirements.
 4. Conditioned spaces are indicated on drawings.
 5. Outdoor/Condenser unit locations are indicated on drawings.
 6. Indoor/Evaporator unit locations are indicated on drawings.
 7. Branch selector unit locations are not indicated on drawings.
 8. Required equipment unit capacities are indicated on drawings.
 9. Refrigerant piping sizes are not indicated on drawings.
 10. Connect equipment to condensate piping provided by others; condensate piping is indicated on drawings.
- B. Refrigerant Piping Lengths: Provide equipment capable of serving system with the piping lengths shown on plans without any oil traps:
- C. Controls: Provide the following control interfaces:
1. For Each Indoor/Evaporator Unit: One wall-mounted wired "local" controller, with temperature sensor; locate where indicated. Some units required a BACnet interface while others require only local wall controllers, refer to plans where indicated on plans.
- D. Local Controllers: Wall-mounted, wired, containing temperature sensor.

2.03 EQUIPMENT

- A. All Units: Factory assembled, wired, and piped and factory tested for function and safety.
 - 1. Refrigerant: R-410A.
 - 2. Performance Certification: AHRI Certified; www.ahrinet.org.
 - 3. Safety Certification: Tested to UL 1995 by UL or Intertek-ETL, listed in ITS (DIR), and bearing the certification label.
 - 4. Provide units capable of serving the zones indicated.
 - 5. Thermal Performance: Provide heating and cooling capacity as indicated, based on the following nominal operating conditions:
 - 6. Energy Efficiency: Report EER and COP based on tests conducted at "full load" in accordance with AHRI 210/240 or alternate test method approved by U.S. Department of Energy.
- B. Electrical Characteristics:
 - 1. Power - Condensing Units: 208 to 230 Volts, single phase, 60 Hz.
 - 2. Power - Indoor Units: 208 to 230 Volts, single phase, 60 Hz.
 - 3. 208-230 Voltage Range: 187 to 253 volts.
 - 4. Control: 16 volts DC.
- C. Refrigerant Piping:
 - 1. Provide hard drawn copper above grade; soft drawn tubing may be used within underground conduits to facilitate pulling through conduit long sweep elbows.
 - 2. Insulate each refrigerant line individually between the condensing and indoor units.
 - 3. Underground piping routed insulated within non-metallic electrical conduit (see Div 26) with control wiring and both insulated pipes bundled periodically along their length.
 - 4. Minimum piping insulation thickness:
 - a. Vapor: 1.5" thick.
 - b. Liquid: 0.5" thick.

2.04 OUTDOOR/CONDENSING UNITS

- A. Outdoor/Condensing Units: Air-cooled DX refrigeration units, designed specifically for use with indoor/evaporator units; factory assembled and wired with all necessary electronic and refrigerant controls; modular design for ganging multiple units.
 - 1. Refrigeration Circuit: Scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator.
 - 2. Refrigerant: Factory charged.
 - 3. Variable Volume Control: Modulate compressor capacity automatically to maintain constant suction and condensing pressures while varying refrigerant volume to suit heating/cooling loads.
 - 4. Capable of being installed with wiring and piping to the left, right, rear or bottom.
 - 5. Capable of heating operation at low end of operating range as specified, without additional low ambient controls or auxiliary heat source; during heating operation, reverse cycle (cooling mode) oil return or defrost is not permitted, due to potential reduction in space temperature.
 - 6. Sound Pressure Level: As specified, measured at 3 feet (one meter) from front of unit; provide night setback sound control as a standard feature; three selectable sound level steps of 55 dB, 50 dB, and 45 dB, maximum.
 - 7. Power Failure Mode: Automatically restart operation after power failure without loss of programmed settings.
 - 8. Safety Devices: High pressure sensor and switch, low pressure sensor/switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.

9. Provide refrigerant sub-cooling to ensure the liquid refrigerant does not flash when supplying to us indoor units.
10. Oil Recovery Cycle: Automatic, occurring 2 hours after start of operation and then every 8 hours of operation; maintain continuous heating during oil return operation.
11. Controls: Provide contacts for electrical demand shedding.
12. Product:
 - a. Daikin RXTQ Series ("heat pump").
- B. Unit Cabinet: Weatherproof and corrosion resistant; rust-proofed mild steel panels coated with baked enamel finish.
 1. Designed to allow side-by-side installation with minimum 4" spacing.
- C. Fans: One or more direct-drive propeller type, vertical discharge, with multiple speed operation via DC (digitally commutating) inverter.
 1. External Static Pressure: Factory set at 0.12 in WG (30 Pa), minimum.
 2. Indoor Mounted Air-Cooled Units: External static pressure field set at 0.32 in WG (80 Pa), minimum; provide for mounting of field-installed ducts.
 3. Fan Airflow: As indicated for specific equipment.
 4. Fan Motors: Factory installed; permanently lubricated bearings; inherent protection; fan guard; output as indicated for specific equipment.
- D. Condenser Coils: Copper tubes expanded into aluminum fins to form mechanical bond; waffle louver fin and rifled bore tube design to ensure high efficiency performance.
- E. Compressors: Scroll type, hermetically sealed, variable speed inverter-driven and fixed speed in combination to suit total capacity; minimum of one variable speed, inverter driven compressor per condenser unit; minimum of two compressors per condenser unit; capable of controlling capacity within range of 6 percent to 100 percent of total capacity.
 1. Variable Speed Control: Capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure; high/low pressures calculated by samplings of evaporator and condenser temperatures every 20 seconds, with compressor capacity adjusted to eliminate deviation from target value by changing inverter frequency or on/off setting of fixed speed compressors.
 2. Failure Mode: In the event of compressor failure, operate remaining compressor(s) at proportionally reduced capacity; provide microprocessor and associated controls specifically designed to address this condition.
 3. Inverter Driven Compressors: PVM inverter driven, highly efficient reluctance DC (digitally commutating), hermetically sealed scroll "G2-type" with maximum speed of 7,980 rpm.
 4. Provide each compressor with crankcase heater, high pressure safety switch, and internal thermal overload protector.
 5. Provide oil separators and intelligent oil management system.
 6. Provide spring mounted vibration isolators.

2.05 INDOOR/EVAPORATOR UNITS

- A. All Indoor/Evaporator Units: Factory assembled and tested DX fan-coil units, with electronic proportional expansion valve, control circuit board, factory wiring and piping, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
 1. Refrigerant: Refrigerant circuits factory-charged with dehydrated air, for field charging.
 2. Temperature Control Mechanism: Return air thermistor and computerized Proportional-Integral-Derivative (PID) control of superheat.
 3. Coils: Direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond; waffle louver fin and high heat exchange, rifled bore tube design; factory tested.
 - a. Provide thermistor on liquid and gas lines.
 4. Fans: Direct-drive, with statically and dynamically balanced impellers; high and low speeds unless otherwise indicated; motor thermally protected.

5. Return Air Filter: Provide with MERV-13 filters and rack, minimum 2" thick, unless otherwise indicated on plans.
 6. Condensate Drainage: Built-in condensate drain pan with PVC or copper drain connection.
 - a. Units With Built-In Condensate Pumps: Provide condensate safety shutoff and alarm.
 - b. Units Without Built-In Condensate Pump: Provide built-in condensate float switch and wiring connections where condensate route cannot be accomplished by gravity alone.
 7. Cabinet Insulation: Sound absorbing foamed polystyrene and polyethylene insulation.
- B. Concealed-In-Ceiling Units: Ducted horizontal discharge and return; galvanized steel cabinet.
1. Return Air Filter: Manufacturer's standard.
 2. Sound Pressure: Measured at low speed at 5 feet (1.5 m) below unit.
 3. Provide external static pressure switch adjustable for high efficiency filter operation
 4. Condensate Pump: Built-in, with lift of 9 inches (229 mm), minimum.
 5. Switch box accessible from side or bottom.
 6. Product(s):
 - a. Daikin FXMQ Series; three-speed direct-drive DC (ECM) type fan with automatic airflow adjustment; external static pressure selectable during commissioning.
- C. Air Handling Units: Factory-painted heavy gage steel casing insulated with sound absorbing foil faced insulation.
1. Horizontal Right or Left Configuration (see plans): Horizontal discharge air and horizontal return air.
 2. Secondary condensate drain pan; field installed.
 3. Fan: Direct-drive ECM type fan with automatic airflow adjustment.
 4. Provide MERV 13 4" air filter.
 5. External insulation; field installed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that required electrical services have been installed and are in the proper locations prior to starting installation.
- B. Verify that condensate piping has been installed and is in the proper location prior to starting installation.
- C. Notify Architect if conditions for installation are unsatisfactory.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install refrigerant piping in accordance with equipment manufacturer's instructions.
- C. Perform wiring in accordance with NFPA 70, National Electric Code (NEC).
- D. Coordinate with installers of systems and equipment connecting to this system.
- E. perform a 50 PSI pneumatic pressure test for min. 48 hours to prove underground joints are water & air tight, leave gauges on during backfill to demonstrate integrity is maintained after burial.

3.03 FIELD QUALITY CONTROL

- A. See Division 1, for additional requirements.
- B. Store conduit to ensure all components stay dry prior to installation. Cover openings to prevent entry of water or debris during installation.
- C. Provide manufacturer's field representative to inspect installation prior to startup.

3.04 SYSTEM STARTUP

- A. Prepare and start equipment and system in accordance with manufacturer's instructions and recommendations.
- B. Adjust equipment for proper operation within manufacturer's published tolerances.

3.05 CLEANING

- A. Clean exposed components of dirt, finger marks, and other disfigurements.

3.06 COMMISSIONING

- A. See Division 1 for commissioning requirements.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 77 00 - Contract Closeout and Final Cleaning, for closeout submittals.
- B. Demonstration: Demonstrate operation of system to Owner's personnel.
 - 1. Use operation and maintenance data as reference during demonstration.
 - 2. Conduct walking tour of project.
 - 3. Briefly describe function, operation, and maintenance of each component.
- C. Training: Train Owner's personnel on operation and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of four hours of training.
 - 3. Instructor: Manufacturer's training personnel or VRV equipment installer.
 - 4. Location: At project site.

3.08 PROTECTION

- A. Protect installed components from subsequent construction operations.
- B. Replace exposed components broken or otherwise damaged beyond repair.

3.09 MAINTENANCE

- A. Provide a separate maintenance contract for specified maintenance service.

END OF SECTION

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**SECTION 23 90 00 -
ENERGY MANAGEMENT AND CONTROL SYSTEM**

PART 1: GENERAL

1.01 SECTION INCLUDES

- A. Description
- B. Approved Control System Manufacturers
- C. Quality Assurance
- D. Codes and Standards
- E. System Performance
- F. Submittals
- G. Warranty
- H. Ownership of Proprietary Material

1.02 DESCRIPTION

- A. General: The control system shall be as shown and consist of a high-speed, peer-to-peer network of DDC controllers and an operator workstation residing and communicating on a BACnet internet work. Each mechanical system, building floor plan, and control device will be depicted by point-and-click graphics.
- B. The control system shall be supplied with a complete web enabled package. The system shall support unlimited users using standard web browsers such as Chrome or Firefox. The web server software shall operate on standard industry PC servers. Proprietary servers or "black boxes" are not acceptable. Web browser software shall be manufactured by the control system manufacturer and shall have the same look and feel as the operating system. Third party web software is not acceptable.
- C. The system will provide for future expansion to include monitoring of the card access, fire alarm, and lighting control systems
- D. APPROVED CONTROL SYSTEM MANUFACTURERS

1.03 APPROVED CONTROL SYSTEM MANUFACTURERS:

Delta Controls			
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- A. Delta Controls by Delta Controls Partners established within a 70 mi radius of the jobsite withing the past three years.
 - 1. The Contractor shall use only products from the corresponding manufacturer and product line listed.
 - 2. The system shall connect to the existing Delta Controls System. New graphics shall be created at this server. The system shall be installed in to match the owners standards including installation methods, graphic screens, programming, alarms, and historical trending to match the existing Delta Control System installed by Environmental Systems, Inc.
 - 3. The above list of manufacturers applies to operator workstation software, controller software, the custom application programming language, Building Controllers, Custom Application Controllers, and Application Specific Controllers. All other products specified herein (e.g., sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

1.04 QUALITY ASSURANCE

- A. Contractor/Manufacturer Qualifications
 - 1. The Installer shall have an established working relationship with the Control System Manufacturer for at least three years.
 - 2. The Installer shall have successfully completed Control System Manufacturer's classes on the control system. The Installer shall present for review the certification of

completed training, including the hours of instruction and course outlines upon request.

3. All products used in this installation shall be new, currently under manufacture, and shall be applied in standard off the shelf products. This installation shall not be used as a test site for any new products unless explicitly approved by the Engineer in writing. Spare parts shall be available for at least 5 years after completion of this contract.

1.05 CODES AND STANDARDS

- A. All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:
 1. National Electric Code (NEC)
 2. Uniform Building Code (UBC)
 - a. Section 710.5, Wiring in Plenums
 - b. Section 1106 Refrigeration Machinery Rooms
 - c. Section 1107, Refrigeration Machinery Room Ventilation
 - d. Section 1108, Refrigeration Machinery Room Equipment and Controls
 - e. Section 1120, Detection and Alarm Systems
 3. Uniform Mechanical Code (UMC)
 4. ASHRAE 135-1995
 5. FCC Regulation, Part 15- Governing Frequency Electromagnetic Interference
 6. Underwriters Laboratories UL916

1.06 SYSTEM PERFORMANCE

- A. Performance Standards. The system shall conform to the following:
 1. Graphic Display. The system shall display a graphic with 20 dynamic points/objects with all current data within 10 seconds.
 2. Graphic Refresh. The system shall update a graphic with 20 dynamic points/objects with all current data within 8 seconds
 3. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be less than 2 seconds. Analog objects should start to adjust within 2 seconds
 4. Object Scan. All changes of state and change of analog values will be transmitted over the high-speed Ethernet network such that any data used or displayed at a controller or workstation will have been current within the previous 2 seconds
 5. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 45 seconds
 6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 1 second. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control
 7. Performance. Programmable controllers shall be able to execute DDC PID control loops at a frequency of at least once per second. The controller shall scan and update the process value and output generated by this calculation at this same frequency
 8. Multiple Alarm Annunciations. All workstations on the network must receive alarms within 5 seconds of each other
 9. Reporting Accuracy. The system shall report all values with an end-to-end accuracy as listed or better than those listed in Table 1
 10. Stability of Control. Control loops shall maintain measured variable at setpoint within the tolerances listed in Table 2

- B. Reporting Accuracy

Measured Variable	Reported Accuracy
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Space Temperature	±0.5°C [±1°F]
Ducted Air	±0.5°C [±1°F]
Outside Air	±1.0°C [±2°F]
Dewpoint	±1.5°C [±3°F]
Water Temperature	±0.5°C [±1°F]
Delta-T	±0.15°C [±0.25°F]
Relative Humidity	±5% RH
Water Flow	±5% of full scale
Airflow (terminal)	±10% of full scale (see Note 1)
Airflow (measuring stations)	±5% of full scale
Air Pressure (ducts)	±25 Pa [±0.1 "W.G.]
Air Pressure (space)	±3 Pa [±0.01 "W.G.]
Water Pressure	±2% of full scale (see Note 2)
Electrical	5% of reading (see Note 3)
(A, V, W, Power factor)	
Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO2)	±50 ppm
Note 1: 10%-100% of scale	
Note 2: For both absolute and differential pressure	
Note 3: Not including utility-supplied meters	

C. Control Stability and Accuracy

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure (w.g.)	±50 Pa [±0.2" w.g.]	0-1.5 kPa [0-6" w.g.]
Airflow	±100 cfm	
Temperature	±0.5°C [±1.0°F]	
Humidity	±5% RH	
Fluid Pressure differential	±10 kPa [±1.5 psi]	0-1 kPa [1-150 psi]
	250 Pa [±1.0" w.g.]	0-12.5 kPa [0-50" w.g.]

1.07 SUBMITTALS

- A. Product Data and Shop Drawings: Contractor shall provide shop drawings or other submittals on all hardware, software, and installation to be provided. No work may begin on any segment of this project until submittals have been reviewed and approved for conformity with the design intent. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Submittals shall be provided within 12 weeks of contract award. Submittals shall include:

1. Direct Digital Control System Hardware:
 - a. A complete bill of materials of equipment to be used shall be listed indicating quantity, manufacturer, model number, and other relevant technical data.
 - b. Manufacturer's description and technical data, such as performance curves, product specification sheets, and installation/maintenance instructions for the items listed below and other relevant items not listed below:
 - 1) Direct Digital Controller (controller panels)
 - 2) Transducers/Transmitters
 - 3) Sensors (including accuracy data)

- 4) Actuators
- 5) Valves
- 6) Relays/Switches
- 7) Control Panels
- 8) Power Supply
- 9) Batteries
- 10) Operator Interface Equipment
- 11) Wiring
- c. Wiring diagrams and layouts for each control panel. Show all termination numbers
- d. Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware
- e. Central System Hardware and Software
 - 1) A complete bill of material of equipment used indicating quantity, manufacturer, model number, and other relevant technical data.
 - 2) Manufacturer's description and technical data, such as product specification sheets and installation/maintenance instructions for the items listed below and other relevant items not listed below:
 - (a) Central Processing Unit
 - (b) Monitors
 - (c) Printers
 - (d) Keyboard
 - (e) Power Supply
 - (f) Battery Backup
 - (g) Interface Equipment Between CPU and Control Panels
 - (h) Operating System Software
 - (i) Operator Interface Software
 - (j) Color Graphic Software
 - (k) Third-party Software
 - 3) A schematic diagram for all control wiring, communication wiring and power wiring shall be provided. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers, function and data link protocol(s). Show all interface wiring to the control system
 - 4) Provide detailed system architecture of wiring between central control unit, operator workstation(s), routers, gateways and all control panels
 - 5) A list of the color graphic screens shall be provided. For each screen, provide a conceptual layout of pictures and data, and show or explain which other screens can be directly accessed
- f. Controlled Systems:
 - 1) A schematic diagram of each controlled system. The schematics shall have all control points/objects labeled and with point/object names shown or listed. The schematics shall graphically show the location of all control elements in the system
 - 2) A schematic wiring diagram for each controlled system. Each schematic shall have all elements labeled. Where a control element is the same as that shown on the control system schematic, it shall be labeled with the same name. All terminals shall be labeled
 - 3) An instrumentation list for each controlled system. Each element of the controlled system shall be listed in table format. The table shall show element name, type of device, manufacturer, model number, and product data sheet number
 - 4) A mounting, wiring, and routing plan view drawing. The drawing shall be done in 1/4" scale. The design shall take into account HVAC, electrical and

other systems' design and elevation requirements. The drawing shall show the specific location of all concrete pads and bases and any special wall bracing for panels to accommodate this work

- 5) A complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system
- 6) A point/object list for each system controller including both inputs and outputs (I/O), point/object number, the controlled device associated with the I/O point/object, and the location of the I/O device. Software flag points/objects, alarm points/objects, etc
- g. Quantities of items submitted shall be reviewed, but are the responsibility of the Contractor
- h. A description of the proposed process along with all report formats and checklists to be used in Part 3: "Control System Demonstration and Acceptance."
- i. A BACnet Protocol Implementation Conformance Statement (PICS) for each type of controller and operator interface included in the submittal. PICS to include for each product, as a minimum, a list of BACnet functional groups supported, BACnet services supported, BACnet data link options available and BACnet objects provided

B. Schedules:

1. Within one month of contract award, provide a schedule of the work indicating the following:
 - a. Intended sequence of work items
 - b. Start dates of individual work items.
 - c. Duration of individual work items
 - d. Planned delivery dates for major material and equipment, and expected lead times
 - e. Milestones indicating possible restraints on work by other trades or situations.

C. Project Record Documents: Upon completion of installation, submit three copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and shall include:

1. Project Record Drawings. These shall be as-built versions of the submittal shop drawings. One set of magnetic media including DXF drawing files also shall be provided
 - a. Testing and Commissioning Reports and Checklists. Completed versions of all reports and checklists, used to meet the requirements of Part 3: "Control System Demonstration and Acceptance."
 - b. Certification of the pressure test required in Part 3: "Control Air Tubing."
 - c. Operation and Maintenance (O & M) Manual. This shall include as-built versions of the submittal product data. In addition to the information required for submittals, the O & M manual shall include:
 - 1) Operators Manual with procedures for operating the control systems, including logging on/off, alarm handling, producing point/object reports, trending data, overriding computer control, and changing setpoints and other variables
 - 2) One set of Programming Manuals with a description of the programming language (including syntax), statement descriptions (including algorithms and calculations used), point/object database creation and modification, program creation and modification, and use of the editor
 - 3) A list of recommended spare parts with part numbers and suppliers
 - 4) Licenses, guarantee, and warranty documents for all equipment and systems
 - 5) Recommended preventive maintenance procedures for all system components, including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions

- D. Manuals: The Contractor shall provide manuals for all equipment provided.

1.08 WARRANTY

- A. Warrant all work as follows:

1. Labor and materials for the control system specified shall be warranted free from defects for a period of 12 months after final completion and acceptance. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner. The Contractor shall respond to the Owner's request for warranty service within 24 hours during normal business hours.
2. All work shall have a single warranty date, even when the Owner has received beneficial use due to an early system start-up. If the work specified is split into multiple contracts or a multi-phase contract, then each contract or phase shall have a separate warranty start date and period
3. Operator workstation software, project-specific software, graphic software, database software, and firmware updates which resolve known software deficiencies as identified by the Contractor shall be provided at no charge during the warranty period. Any upgrades or functional enhancements associated with the above mentioned items also can be provided during the warranty period for an additional charge to the Owner by purchasing an in-warranty service agreement from the Contractor. Written authorization by the Owner must, however, be granted prior to the installation of any of the above mentioned items.
4. Exception: The Contractor shall not be required to warrant reused devices, except for those that have been rebuilt and/or repaired. The Contractor shall warrant all installation labor and materials, however, and shall demonstrate that all reused devices are in operable condition at the time of Engineer's acceptance.

1.09 OWNERSHIP OF PROPRIETARY MATERIAL

- A. All project-developed software and documentation shall become the property of the Owner. These include, but are not limited to:
1. Project graphic images
 2. Record drawings
 3. Project database
 4. Project-specific application programming code
 5. All documentation

PART 2: PRODUCTS

2.01 SECTION INCLUDES

- A. Materials
- B. Communication
- C. Operator Workstation
- D. Controller Software
- E. Building Controllers
- F. Advanced Application Controllers
- G. Application Specific Controllers
- H. Input/ Output Interface
- I. Power Supplies and Line Filtering
- J. Auxiliary Control Devices
- K. Wiring and Raceways
- L. Fiber Optic Cable System

2.02 MATERIALS

- A. All products used in this project installation shall be new, currently under manufacture, and shall be applied in similar installations for a minimum of two years. This installation shall not be used as a test site for any new products unless explicitly approved by the Owner's Representative in writing. Spare parts shall be available for at least five years after completion of this contract.

2.03 COMMUNICATION

- A. All control products provided for this project shall comprise a BACnet internetwork. Communication involving control components (i.e., all types of controllers and Operator Workstations) shall conform to ANSI/ASHRAE Standard 135-2001, BACnet.
- B. Each BACnet device shall operate on the BACnet Data Link/Physical layer protocol specified for that device as defined in this section.
- C. The Contractor shall provide all communication media, connectors, repeaters, bridges, hubs, switches, and routers necessary for the internetwork.
- D. All controllers shall have a communication port for connections with the Operator Workstations using the BACnet Data Link/ Physical layer protocol.
- E. Communication services over the internetwork shall result in operator interface and value passing that is transparent to the internetwork architecture as follows:
 - 1. Connection of an Operator Workstation device to any one controller on the internetwork will allow the operator to interface with all other controllers as if that interface were directly connected to the other controllers. Data, status information, reports, system software, custom programs, etc., for all controllers shall be available for viewing and editing from any one controller on the internetwork.
 - 2. All database values (e.g., objects, software variables, custom program variables) of any one controller shall be readable by any other controller on the internetwork. This value passing shall be automatically performed by a controller when a reference to an object name not located in that controller is entered into the controller's database. An operator/installer shall not be required to set up any communication services to perform internetwork value passing.
- F. The time clocks in all controllers shall be automatically synchronized daily. An operator change to the time clock in any controller shall be automatically broadcast to all controllers on the network.

2.04 OPERATOR WORKSTATION

- A. Operator Workstation. Not needed, interface with Existing PC-based system.
- B. System Graphics. The existing operator workstation software shall be expanded to include new graphics to match the remodeled systems.

2.05 CONTROLLER SOFTWARE

- A. Furnish the following applications software for building and energy management. All software applications shall reside and operate in the system controllers. Editing of applications shall occur at the operator workstation
- B. System Security
 - 1. User access shall be secured using individual security passwords and user names.
 - 2. Passwords shall restrict the user to the objects, applications, and system functions as assigned by the system manager.
 - 3. User Log On/Log Off attempts shall be recorded.
- C. Scheduling. Provide the capability to schedule each object or group of objects in the system. Each schedule shall consist of the following:
 - 1. Weekly Schedule. Provide separate schedules for each day of the week. Each of these schedules should include the capability for start, stop and optimal start. Each

schedule may consist of up to 10 events. When a group of objects are scheduled together, provide the capability to adjust the start and stop times for each member.

2. Holiday Schedules. Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.

2.06 BUILDING CONTROLLERS

- A. General. Provide an adequate number of Building Controllers to achieve the performance specified in the Part 1 Article on "System Performance." Each of these panels shall meet the following requirements.
 1. The Energy Management and Control System shall be comprised of one or more independent, standalone, microprocessor-based Building Controllers to manage the global strategies described in the System Software section.
 2. The Building Controller shall have sufficient memory to support its operating system, database, and programming requirements.
 3. Data shall be shared between networked Building Controllers.
 4. The operating system of the Building Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms.
 5. Controllers that perform scheduling shall have a real-time clock.
 6. The Building Controller shall communicate with other BACnet objects on the internetwork using the Read (Execute and Initiate) and Write (Execute and Initiate) Property services as defined in ASHRAE Standard 135-2020.
 7. BACnet Functional Groups. The Building Controller shall support the following BACnet functional groups: Clock, Event Initiation, COV Event Response, Files, Device Communication and Time Master.
- B. Communication
 1. Each Building Controller shall support BACnet™ over Ethernet and BACnet™ over IP. The Building Controller shall be connected to the BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol.
 2. Each Building Controller with a communications card shall perform BACnet routing if connected to a network of Custom Application and Application Specific Controllers.
 3. The Building Controller secondary communication network shall support BACnet MS/TP.
- C. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.
 1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 0°C to 40°C [32°F to 100°F] and 10 to 90% RH.
 2. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 50°C [32°F to 120°F].
- D. Building Controllers shall be fully peer to peer.
- E. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips.
- F. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. The Building Controller shall maintain all database information including BIOS and programming information in the event of a power loss for at least 72 hours. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m [3 ft].
- G. Inputs/Outputs.
 1. Inputs. Controller input/output board shall support dry contact, 0-5 VDC and 0-10 VDC- voltage, 4-20 mA- current and thermistor-resistive signal types (10K ohm) on an individual basis for connecting any status or sensing device.

2. Outputs. Output supported shall be 0-10 VDC, 24 VAC triac, 24 VAC dry contact. All HOA's shall be supervised.
3. Diagnostics. Controller input/output board shall have red LEDs providing input status indication.
4. Building Controller shall have the capability to create, delete and support the following BACnet Objects:
 - a. ANALOG INPUT, ANALOG OUTPUT AND ANALOG VALUE: These objects shall have the following writeable properties: Object Name; Object Value; Description; COV Increment; Out of Service and Units. In addition, these objects shall support the properties: Device type; Reliability; Min./Max. Values; Update Interval and Resolution.
 - b. BINARY INPUT, BINARY OUTPUT AND BINARY VALUE: These objects shall have the following writeable properties: Object Name; Object Value; Description; Polarity; Default Value; Min On/Off and Out of Service. In addition, these objects shall support the properties: Device Type; Reliability; Active/Inactive Texts; Update Interval; Resolution; Change-of-State Time; Count Times and Time Reset.
 - c. CALENDAR: This object shall have the following writeable properties: Object Name; Object Value; Description; and Date List.
 - d. DEVICE: This object shall have the following writeable properties: Object Name; Description; Location; and UTC Offset.
 - e. EVENT ENROLMENT: This object shall have the following writeable properties: Object Name; Object Value; Description; Out-of-Service; Event & Notify Types; Parameters; Property Ref; Enable; and Notification Class.
 - f. FILE: This object shall have the following writeable properties: Object Name; Description; File Type; and File Access.
 - g. LOOP (PID): This object shall have the following writeable properties: Object Name; Object Value; Description; Polarity; Output and Input Refs.; Input Value & Units; Setpoint Value; PID Values; Bias; Write Priority and COV Increment. In addition, this object shall support the properties: Reliability; Update Interval; Proportional Constant & Units; Derivative Constant & Units.
 - h. NOTIFICATION CLASS: This object shall have the following writeable properties: Object Name; Object Value; Description; Priority and Ack Required.
 - i. PROGRAM: This object shall have the following writeable properties: Object Name; Object Value and Description. In addition, this object shall support the property Reliability.
 - j. SCHEDULE: This object shall have the following writeable properties: Object Name; Object Value and Description; Effective period; Schedule; Exception; Controlled Properties and Write Properties.
 - k. TREND LOG: This object shall have the following writeable properties: Object Name; Description; Log Enable; Start/stop Times; Log Device Object Property; Log Interval; Stop When Full; Buffer Size; and Record Count.

2.07 ADVANCED APPLICATION CONTROLLERS

- A. General. Provide an adequate number of Programmable Application Controllers to achieve the performance specified in the Part 1 Article on "System Performance." Each of these panels shall meet the following requirements.
 1. The Advanced Application Controller shall have sufficient memory to support its operating system, database, and programming requirements.
 2. Advanced Application Controllers shall be fully peer to peer.
 3. The operating system of the Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information, and allow central monitoring and alarms.
 4. Both firmware and controller database shall be loadable over the network.
- B. Communication.

1. Each Advanced Application Controller shall reside on a BACnet network using the MS/TP or Ethernet Data Link/ Physical layer protocol.
 2. The controller shall provide a service communication port using BACnet Data Link/ Physical layer protocol for connection to portable operators' workstation and allow access to the entire network.
- C. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.
1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at 0°C to 40°C [32°F to 100°F].
 2. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 0°C to 50°C [32°F to 120°F].
- D. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips — or to a termination card connected by a ribbon cable.
- E. Memory. The Advanced Application Controller shall be non-volatile FLASH memory.
- F. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m [3 ft].

2.08 APPLICATION SPECIFIC CONTROLLERS

- A. General. Application Specific Controllers (ASCs) are microprocessor-based DDC controllers which through hardware or firmware design are able to control a wide variety of equipment. They are fully user-programmable, and are not restricted to any one type of equipment.
1. Each ASC shall be capable of standalone operation and shall continue to provide control functions without being connected to the network
 2. Each ASC will contain sufficient I/O capacity to control the target system.
 3. Both firmware and controller database shall be loadable over the network
 4. Application Specific Controllers shall be fully peer to peer
 5. ASC's shall come with an integrated housing to allow for easy mounting and protection of the circuit board. Only wiring terminals shall be exposed.
- B. Communication
1. The controller shall reside on a BACnet network using the MS/TP Data Link/ Physical layer protocol.
 2. Each controller shall have a BACnet Data Link/ Physical layer compatible connection for a laptop computer or a portable operator's tool. This connection shall be extended to a space temperature sensor port where shown and allow access to the entire network.
 3. Each controller shall have a secondary sub network for communicating sensors or I/O expansion modules
- C. Environment. The hardware shall be suitable for the anticipated ambient conditions.
1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at -40°C to 65°C [-40°F to 150°F] and/or suitably installed in a heated or fan cooled enclosure
 2. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 50°C [32°F to 120°F].
- D. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips.
- E. Memory. The Application Specific Controller shall use non-volatile memory and maintain all BIOS and programming information in the event of a power loss.

- F. Immunity to power and noise. ASC shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 W at 1 m [3 ft].
- G. Transformer. Power supply for the ASC must be rated at minimum of 125% of ASC power consumption and shall be fused or current limiting type.
- H. Input/Output. ASC shall support as a minimum, directly connected, a combination of analog outputs and binary outputs and universal software selectable analog or digital inputs. ASC inputs shall support 0-5 VDC-voltage, 4-20mA-current, thermistor-resistance and dry contacts. ASC outputs shall support 0-10 VDC-voltage, digital triac rated at 0.5 amps at 24 VAC

2.09 AUXILIARY CONTROL DEVICES

- A. Existing auxiliary control devices, wiring, and panels may be utilized when possible.
- B. Motorized control dampers, unless otherwise specified else where, shall be furnished by the controls contractor.
- C. Electric damper/valve actuators.
 - 1. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.
 - 2. Where shown, for power-failure/safety applications, an internal mechanical, spring-return mechanism shall be built into the actuator housing.
 - 3. All non-spring-return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring-return actuators with more than 7 N·m [60 in-lb] torque capacity shall have a manual crank for this purpose.
- D. Control valves.
 - 1. Control valves shall be two-way or three-way type for two-position or modulating service as shown.
 - 2. Water Valves:
 - a. Body and trim style and materials shall be per manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
 - 3. Steam Valves:
 - a. Body and trim materials shall be per manufacturer's recommendations for design conditions and service. Linear ports for modulating service.
- E. Binary Temperature Devices
 - 1. Low-limit thermostats. Low-limit thermostats shall be vapor pressure type with an element 6 m [20 ft] minimum length. Element shall respond to the lowest temperature sensed by any 30 cm [1 ft] section. The low-limit thermostat shall be manual reset only and be supplied as DPST.
- F. Temperature sensors.
 - 1. Temperature sensors shall be thermistors.
 - 2. Space sensors shall be equipped with the following:
 - a. programmable buttons for setpoint adjustment and override
 - b. 3-value, 96-segment LCD display
 - 3. Provide matched temperature sensors for differential temperature measurement.
- G. Humidity sensors.
 - 1. Duct and room sensors shall have a sensing range of 0% to 100%.
 - 2. Outdoor air humidity sensors shall have a sensing range of 20% to 95% RH. They shall be suitable for ambient conditions of -40°C to 75°C [-40°F to 170°F].
 - 3. Humidity sensor's drift shall not exceed 3% of full scale per year.
- H. Flow switches.

1. Flow-proving switches shall be either paddle or differential pressure type
- I. Local control panels
 1. All indoor control cabinets shall be fully enclosed NEMA 1 construction with [hinged door], and removable sub-panels.
 2. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL Listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings

2.10 WIRING AND RACEWAYS

- A. General: Provide copper wiring, plenum cable, and raceways in accordance to local code.
- B. Existing wiring and raceways may be reused where possible.

PART 3: EXECUTION

3.01 SECTION INCLUDES

- A. Examination
- B. Protection
- C. Coordination
- D. General Workmanship
- E. Field Quality Control
- F. Existing Equipment
- G. Wiring
- H. Communication Wiring
- I. Fiber Optic Cable
- J. Control Air Tubing
- K. Installation of Sensors
- L. Flow Switch Installation
- M. Actuators
- N. Warning Labels
- O. Identification of Hardware and Wiring
- P. Controllers
- Q. Programming
- R. Control System Checkout and Testing
- S. Control System Demonstration and Acceptance
- T. Cleaning

3.02 EXAMINATION

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started
- B. The Contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started
- C. The Contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate — or if any discrepancies occur between

the plans and the Contractor's work, and the plans and the work of others — the Contractor shall report these discrepancies to the Engineer and shall obtain written instructions for any changes necessary to accommodate the Contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the Contractor to report such discrepancies shall be made by — and at the expense of — this Contractor.

3.03 PROTECTION

- A. The Contractor shall protect all work and material from damage by its work or employees, and shall be liable for all damage thus caused
- B. The Contractor shall be responsible for its work and equipment until finally inspected, tested, and accepted. The Contractor shall protect any material that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects

3.04 COORDINATION

- A. Site
 - 1. Where the mechanical work will be installed in close proximity to, or will interfere with work of other trades, the Contractor shall assist in working out space conditions to make a satisfactory adjustment. If the Contractor installs its work before coordinating with other trades, so as to cause any interference with work of other trades.
 - 2. Coordinate and schedule work with all other work in the same area, or with work which is dependent upon other work, to facilitate mutual progress.

3.05 GENERAL WORKMANSHIP

- A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment
- C. Install all equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electrical Code (NEC).
- D. All wiring shall be verified for its integrity to ensure continuity and freedom from shorts and grounds
- E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.06 FIELD QUALITY CONTROL

- A. All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this specification
- B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship
- C. Contractor shall have work inspected by local and/or state/provincial authorities having jurisdiction over the work

3.07 EXISTING EQUIPMENT

- A. Wiring: The contractor may reuse any abandoned wires. The integrity of the wire and its proper application to the installation is the responsibility of the Contractor. The wire shall be properly identified and tested as per this specification. Unused or redundant wiring must be properly identified as such.
- B. Local Control Panels: The Contractor may reuse any existing local control panel to locate new equipment. All redundant equipment within these panels must be removed. Panel face cover must be patched to fill all holes caused by removal of unused equipment, or replaced with new. Existing panels become the property of the Contractor.

- C. Unless otherwise directed, the Contractor is not responsible for the repairs or replacement of existing energy equipment and systems, valves, dampers, or actuators. Should the Contractor find existing equipment which requires maintenance, the Owner is to be notified immediately.
- D. Temperature Sensor Wells: The Contractor may reuse any existing wells in piping for temperature sensors. These wells shall be modified as required for proper fit of new sensors
- E. Room Thermostats: Shall be removed and become the property of the Owner, unless otherwise noted
- F. Electronic Sensors and Transmitters: Unless specifically noted otherwise Shall be removed and become the property of the Owner, unless otherwise noted

3.08 WIRING

- A. All control and interlock wiring shall comply with national and local electrical codes.
- B. All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)

3.09 ACTUATORS

- A. Mount and link control damper actuators per manufacturer's instructions.
 - 1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage
 - 2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
 - 3. Provide all mounting hardware and linkages for actuator installation.

3.10 ELECTRIC/ELECTRONIC

- A. Dampers: Actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° available for tightening the damper seals. Actuators shall be mounted following manufacturer's recommendations
- B. Valves: Valves controlled as part of this project will be provided by EMCS contractor for installation by others.

3.11 IDENTIFICATION OF HARDWARE AND WIRING

- A. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 5 cm [2"] of termination with the DDC address or termination number.

3.12 PERMANENTLY LABEL OR CODE EACH POINT/OBJECT OF FIELD TERMINAL STRIPS TO SHOW THE INSTRUMENT OR ITEM SERVED.

- A. Identify control panels with minimum 1 cm [½"] letters on laminated plastic nameplates.
- B. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.
- C. Identify room sensors relating to terminal box or valves with nameplates.

3.13 CONTROLLERS

- A. Building Controllers and Advanced Application Controllers shall be selected to provide a minimum of 15% spare I/O point/object capacity for each point/object type found at each location. If input /objects are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point/object used.
 - 1. Future use of spare capacity shall require providing the field device, field wiring, point/object database definition, and custom software. No additional controller boards or point/object modules shall be required to implement use of these spare points

3.14 PROGRAMMING

- A. Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of 25% of available memory free for future use.
- B. Point/object Naming: System point/object names shall be modular in design, allowing easy operator interface without the use of a written point/object index. Use the following naming convention:
- C. Software Programming
 - 1. Provide programming for the system and adhere to the sequences of operation provided. The Contractor also shall provide all other system programming necessary for the operation of the system, but not specified in this document. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:
 - a. Text-based:
 - 1) must provide actions for all possible situations
 - 2) must be modular and structured
 - 3) must be commented
 - b. Parameter-based
 - 1) must provide actions for all possible situations
 - 2) must be documented
- D. Operator Interface
 - 1. Standard Graphics. Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point/object information on the graphic displays shall dynamically update. Show on each graphic all input and output points/objects for the system. Also show relevant calculated points/objects such as setpoints
 - 2. The Contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all Operator Workstation software and their functions as described in this section. This includes any operating system software, the Operator Workstation database, and any third-party software installation and integration required for successful operation of the operator interface

3.15 CONTROL SYSTEM CHECKOUT AND TESTING

- A. Start-up Testing: All testing listed in this article shall be performed by the Contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the Owner's Representative is notified of the system demonstration.
 - 1. The Contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification
 - 2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight
 - 3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures per manufacturers' recommendations
 - 4. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct
 - 5. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The Contractor shall check all control valves and automatic dampers to ensure proper action and closure. The Contractor shall make any necessary adjustments to valve stem and damper blade travel

6. Verify that the system operation adheres to the Sequences of Operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimum Start/Stop routines.
7. Alarms and Interlocks
 - a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm
 - b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
 - c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action

3.16 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

- A. Demonstration
 1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed its own tests
 2. The tests described in this section are to be performed in addition to the tests that the Contractor performs as a necessary part of the installation, startup, and debugging process and as specified in the "Control System Checkout and Testing" Article in Part 3 of this specification.
 3. The demonstration process shall follow that approved in Part 1: "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration
 4. The Contractor shall provide a person equipped with two-way communication and shall demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point/object and system. Any test equipment required to prove the proper operation shall be provided by and operated by the Contractor.
 5. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.
 6. Demonstrate compliance with Part 1: "System Performance
 7. Demonstrate compliance with Sequences of Operation through all modes of operation
 8. Demonstrate complete operation of Operator Workstation
 9. Additionally, the following items shall be demonstrated:
 - a. DDC Loop Response. The Contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in setpoint, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the setpoint, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.
 - b. Demand limiting. The Contractor shall supply a trend data output showing the action of the demand-limiting algorithm. The data shall document the action on a minute-by-minute basis over at least a 30-minute period. Included in the trend shall be building kW, demand limiting setpoint, and the status of shed-able equipment outputs.
 - c. Optimum Start/Stop. The Contractor shall supply a trend data output showing the capability of the algorithm.
 - d. Interface to the building fire alarm system if applicable
 - e. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The Contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

B. Acceptance

1. All tests described in this specification shall have been performed to the satisfaction of both the Engineer and Owner prior to the acceptance of the control system as meeting the requirements of Completion. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Engineer. Such tests shall then be performed as part of the warranty.
2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1: "Submittals."

C. CLEANING

1. The Contractor shall clean up all debris resulting from its activities daily. The Contractor shall remove all cartons, containers, crates, etc., under its control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.
2. At the completion of work in any area, the Contractor shall clean all of its work, equipment, etc., keeping it free from dust, dirt, and debris, etc.
3. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas

END OF SECTION

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SECTION 26 05 13 - MEDIUM-VOLTAGE CABLES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes cables and related cable splices, terminations, and accessories for medium-voltage (2001 to 35,000 V) electrical distribution systems.

1.02 DEFINITIONS

- A. Jacket: A continuous nonmetallic outer covering for conductors or cables.
- B. NETA ATS: Acceptance Testing Specification.
- C. Sheath: A continuous metallic covering for conductors or cables.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of cable. Include splices and terminations for cables and cable accessories.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Indicate location of each cable, splice, and termination.
- B. Qualification Data: For Installer.
- C. Material Certificates: For each type of cable and accessory.
- D. Design Data: Cable pulling calculations, including conduit size and fill percentage, pulling tensions, cable sidewall pressure, jam probability, voltage drop, and ground wire sizing for each cable.
- E. Source quality-control reports.
- F. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Installer: Engage a cable splicer, trained and certified by splice material manufacturer, to install, splice, and terminate medium-voltage cable.
- B. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

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1.06 FIELD CONDITIONS

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than five days in advance of proposed interruption of electric service.
 - 2. Do not proceed with interruption of electric service without Owner's written permission.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- 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. Comply with IEEE C2 and NFPA 70.
- C. Source Limitations: Obtain cables and accessories from single source from single manufacturer.

2.02 CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aetna Insulated Wire, Inc.
 - 2. Kerite Co. (The).
 - 3. Okonite Company (The).
 - 4. Southwire Company.
- B. Cable Type: Type MV 105.
- C. Conductor Insulation: Ethylene-propylene rubber.
 - 1. Voltage Rating: 15kV.
 - 2. Insulation Thickness: 133 percent insulation level.
- D. Conductor: Copper.
- E. Comply with UL 1072, AEIC CS8, ICEA S-93-639/NEMA WC 74, and ICEA S-97-682.
- F. Conductor Stranding: Compact round, concentric lay, Class B.
- G. Shielding: Copper tape, helically applied over semiconducting insulation shield. Minimum of 12.5% overlap.
- H. Cable Jacket: Sunlight-resistant PVC.

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2.03 CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M.
 2. Cooper Power Systems, an Eaton business.
 3. G&W Electric Company.
- B. Comply with ANSI C119.4 for connectors between aluminum conductors or for connections between aluminum to copper conductors.

2.04 SEPARABLE INSULATED CONNECTORS

- A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M.
 2. Cooper Power Systems, an Eaton business.
 3. Raychem; TE Connectivity.
- C. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.
- D. Dead-Break Cable Terminators: Elbow-type unit with 600-A continuous-current rating; designed for de-energized disconnecting and connecting; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.
- E. Dead-Front Terminal Junctions: Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless-steel mounting brackets, and attaching hardware.
1. Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire.
 2. Portable Feed-Through Accessory: Two-terminal, dead-front junction arranged for removable mounting on accessory stand of stationary terminal junction.
 3. Grounding Kit: Jumpered elbows, portable feed-through accessory units, protective caps, test rods suitable for concurrently grounding three phases of feeders, and carrying case.
 4. Standoff Insulator: Portable, single dead-front terminal for removable mounting on accessory stand of stationary terminal junction. Insulators suitable for fully insulated isolation of energized cable-elbow terminator.

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- F. Test-Point Fault Indicators: Applicable current-trip ratings and arranged for installation in test points of load-break separable connectors, and complete with self-resetting indicators capable of being installed with shotgun hot stick and tested with test tool.
- G. Tool Set: Shotgun hot stick with energized terminal indicator, fault-indicator test tool, and carrying case.

2.05 MEDIUM-VOLTAGE TAPES

- A. Description: Electrical grade, insulating tape rated for medium voltage application.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M.
 - 2. Cooper Power Systems, an Eaton business.
 - 3. Raychem; TE Connectivity.
- C. Ethylene/propylene rubber-based, 30-mil (0.76-mm) splicing tape, rated for 130 deg C operation. Minimum 3/4 inch (20 mm) wide.
- D. Silicone rubber-based, 12-mil (0.30-mm) self-fusing tape, rated for 130 deg C operation. Minimum 1-1/2 inches (38 mm) wide.

2.06 ARC-PROOFING MATERIALS

- A. Description: Fire retardant, providing arc flash protection.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M.
 - 2. Cooper Power Systems, an Eaton business.
 - 3. Raychem; TE Connectivity.
- C. Tape for First Course on Metal Objects: 10-mil- (250-micrometer-) thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.
- D. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch (8 mm) thick, and compatible with cable jacket.
- E. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1 inch (25 mm) wide.

2.07 FAULT INDICATORS

- A. Indicators: Manually reset fault indicator with inrush restraint feature, arranged to clamp to cable sheath and provide a display after a fault has occurred in cable. Instrument shall not be

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affected by heat, moisture, and corrosive conditions and shall be recommended by manufacturer for installation conditions.

2.08 SOURCE QUALITY CONTROL

- A. Test and inspect cables according to ICEA S-97-682 before shipping.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install cables according to IEEE 576.
- B. Proof conduits prior to conductor installation by passing a wire brush mandrel and then a rubber duct swab through the conduit. Separate the wire brush and the rubber swab by 48 to 72 inches (1200 to 1800 mm) on the pull rope.
 - 1. Wire Brush Mandrel: Consists of a length of brush approximately the size of the conduit inner diameter with stiff steel bristles and an eye on each end for attaching the pull ropes. If an obstruction is felt, pull the brush back and forth repeatedly to break up the obstruction.
 - 2. Rubber Duct Swab: Consists of a series of rubber discs approximately the size of the conduit inner diameter on a length of steel cable with an eye on each end for attaching the pull ropes. Pull the rubber duct swab through the duct to extract loose debris from the duct.
- C. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 - 1. Where necessary, use manufacturer-approved pulling compound or lubricant that does not deteriorate conductor or insulation.
 - 2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips, that do not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.
 - 3. Use pull-in guides, cable feeders, and draw-in protectors as required to protect cables during installation.
 - 4. Do not pull cables with ends unsealed. Seal cable ends with rubber tape.
- D. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- E. Install "buried-cable" warning tape 12 inches (305 mm) above cables.
- F. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit; support cables at intervals adequate to prevent sag.
- G. Install sufficient cable length to remove cable ends under pulling grips. Remove length of conductor damaged during pulling.
- H. Install cable splices at pull points and elsewhere as indicated; use standard kits.[Use dead-front separable watertight connectors in manholes and other locations subject to water infiltration.]

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- I. Install separable insulated-connector components as follows:
 1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
 2. Portable Feed-Through Accessory: At each terminal junction, with one on each terminal.
 3. Standoff Insulator: At each terminal junction, with one on each terminal.
- J. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:
 1. Clean cable sheath.
 2. Wrap metallic cable components with 10-mil (250-micrometer) pipe-wrapping tape.
 3. Smooth surface contours with electrical insulation putty.
 4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
 5. Band arc-proofing tape with two layers of 1-inch- (25-mm-) wide half-lapped, adhesive, glass-cloth tape at each end of the arc-proof tape.
- K. Seal around cables passing through fire-rated elements according to Section 078413 "Penetration Firestopping."
- L. Install fault indicators on each phase where indicated.
- M. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.
- N. Identify cables according to Section 260553 "Identification for Electrical Systems." Identify phase and circuit number of each conductor at each splice, termination, pull point, and junction box. Arrange identification so that it is unnecessary to move the cable or conductor to read the identification.

3.02 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections:
 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
 2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
 3. Perform direct-current High Potential test of each new conductor according to NETA ATS, Ch. 7.3.3. Do not exceed cable manufacturer's recommended maximum test voltage.
 4. Perform Partial Discharge test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
 5. Perform Dissipation Factor test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
- C. Medium-voltage cables will be considered defective if they do not pass tests and inspections.

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D. Prepare test and inspection reports.

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SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Copper building wire rated 600 V or less.
 - 2. Metal-clad cable, Type MC, rated 600 V or less.
 - 3. Armored cable, Type AC, rated 600 V or less.
 - 4. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
 - 1. Section 260513 "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 601 to 35,000 V.

1.02 DEFINITIONS

- A. PV: Photovoltaic.
- B. RoHS: Restriction of Hazardous Substances.
- C. VFC: Variable-frequency controller.

1.03 ACTION SUBMITTALS

- A. Product Schedule: Indicate type, use, location, and termination locations.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 PRODUCTS

2.01 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

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B. 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. Alpha Wire Company.
2. American Bare Conductor.
3. Belden Inc.
4. Cerro Wire LLC.
5. Encore Wire Corporation.
6. General Cable Technologies Corporation.
7. Okonite Company (The).
8. Service Wire Co.
9. Southwire Company.
10. WESCO.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:

1. Type NM: Comply with UL 83 and UL 719.
2. Type RHH and Type RHW-2: Comply with UL 44.
3. Type USE-2 and Type SE: Comply with UL 854.
4. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
5. Type THHN and Type THWN-2: Comply with UL 83.
6. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
7. Type UF: Comply with UL 83 and UL 493.
8. Type XHHW-2: Comply with UL 44.

2.02 ARMORED CABLE, TYPE AC

If retaining multiple types of conductor or cable, indicate where used on Drawings.

A. Description: A factory assembly of insulated current-carrying conductors with or without an equipment grounding conductor in an overall metallic sheath.

B. 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. Alpha Wire Company.
2. American Bare Conductor.
3. Belden Inc.
4. Cerro Wire LLC.

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5. Encore Wire Corporation.
6. General Cable Technologies Corporation.
7. Okonite Company (The).
8. Service Wire Co.
9. Southwire Company.
10. WESCO.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Comply with UL 4.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit and multicircuit with color-coded conductors.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation: Type THHN/THWN-2. Comply with UL 83.

H. Armor: Steel, interlocked.

2.03 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. 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. 3M Electrical Products.
2. AFC Cable Systems; a part of Atkore International.
3. Gardner Bender.
4. Hubbell Power Systems, Inc.
5. Ideal Industries, Inc.
6. ILSCO.
7. NSi Industries LLC.
8. O-Z/Gedney; a brand of Emerson Industrial Automation.
9. Service Wire Co.

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10. TE Connectivity Ltd.
11. Thomas & Betts Corporation; A Member of the ABB Group.

- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 1. Material: Copper.
 2. Type: Two hole with long barrels.
 3. Termination: Crimp.

PART 3 EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- D. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.
- E. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.
- F. PV Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway .
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Feeders Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.
- F. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.

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- G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- I. **VFC Output Circuits: Type XHHW-2 in metal conduit Type TC-ER cable with braided shield.**

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

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3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.08 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 2. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports to record the following:
 1. Procedures used.
 2. Results that comply with requirements.

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3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

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SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Ground bonding common with lightning protection system.
 - 3. Foundation steel electrodes.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Ground rings.
 - 4. Grounding arrangements and connections for separately derived systems.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1) Test wells.
 - 2) Ground rods.
 - 3) Ground rings.
 - 4) Grounding arrangements and connections for separately derived systems.

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PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- 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. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 MANUFACTURERS

- 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. Burndy; Part of Hubbell Electrical Systems.
 - 2. ERICO International Corporation.
 - 3. ILSCO.
 - 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 5. SIEMENS Industry, Inc.; Energy Management Division.
 - 6. Thomas & Betts Corporation; A Member of the ABB Group.

2.03 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.04 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

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- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- J. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- K. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- L. Straps: Solid copper, cast-bronze clamp. Rated for 600 A.
- M. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal two-piece clamp.
- N. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- O. Water Pipe Clamps:
 - 1. Mechanical type, two pieces with zinc-plated bolts.
 - a. Material: Die-cast zinc alloy.
 - b. Listed for direct burial.
 - 2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.05 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).
- B. Ground Plates: 1/4 inch (6 mm) thick, hot-dip galvanized.

PART 3 EXECUTION

3.01 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

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- B. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.04 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.05 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

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- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.
- E. Metallic Fences: Comply with requirements of IEEE C2.
 - 1. Grounding Conductor: Bare copper, not less than No. 8 AWG.
 - 2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
 - 3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.06 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. Use exothermic welds for all below-grade connections.
 - 3. For grounding electrode system, install at least three rods spaced at least two -rod lengths from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.
 - 1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

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- E. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.
1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
- H. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 2. Make connections with clean, bare metal at points of contact.
 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.07 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test

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wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

- a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- B. Grounding system will be considered defective if it does not pass tests and inspections.
 - C. Prepare test and inspection reports.
 - D. Report measured ground resistances that exceed the following values:
 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 2. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
 3. Pad-Mounted Equipment: 5 ohms.
 4. Manhole Grounds: 10 ohms.
 - E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

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SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Steel slotted support systems.
 - 2. Aluminum slotted support systems.
 - 3. Nonmetallic slotted support systems.
 - 4. Conduit and cable support devices.
 - 5. Support for conductors in vertical conduit.
 - 6. Structural steel for fabricated supports and restraints.
 - 7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
 - 8. Fabricated metal equipment support assemblies.
- B. Related Requirements:
 - 1. Section 260548.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.02 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Ductwork, piping, fittings, and supports.
 - 3. Structural members to which hangers and supports will be attached.
 - 4. Items penetrating finished ceiling, including the following:
 - a. Luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Projectors.
- B. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

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PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the supported equipment and systems will be fully operational after the seismic event."
 - 2. Component Importance Factor: 1.5.

2.02 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- (10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
 - 1. 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:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. B-line, an Eaton business.
 - c. Thomas & Betts Corporation; A Member of the ABB Group.
 - d. Unistrut; Part of Atkore International.
 - 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 3. Material for Channel, Fittings, and Accessories: Galvanized steel.
 - 4. Channel Width: Selected for applicable load criteria.
 - 5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

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1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - 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) B-line, an Eaton business.
 - 2) Hilti, Inc.
2. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

2.03 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 EXECUTION

3.01 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 1. NECA 1.
 2. NECA 101
 3. NECA 102.
 4. NECA 105.
- B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

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- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 50 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. 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).
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 - 6. To Light Steel: Sheet metal screws.
 - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

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- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 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 minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

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SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings.
 - 2. Nonmetallic conduits and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Boxes, enclosures, and cabinets.
 - 5. Handholes and boxes for exterior underground cabling.
- B. Related Requirements:
 - 1. Section 078400 "Firestopping" for firestopping at conduit and box entrances.
 - 2. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.02 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
 - 3. Where raceways are crossing exposed ceiling spaces visible to the building occupants
- B. Qualification Data: For professional engineer.
- C. Source quality-control reports.

PART 2 PRODUCTS

2.01 METAL CONDUITS AND FITTINGS

- A. Metal Conduit:

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1. 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:
 - a. AFC Cable Systems; a part of Atkore International.
 - b. Allied Tube & Conduit; a part of Atkore International.
 - c. Calconduit.
 - d. Electri-Flex Company.
 - e. FSR Inc.
 - f. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - g. Patriot Aluminum Products, LLC.
 - h. Thomas & Betts Corporation; A Member of the ABB Group.
 - i. Western Tube and Conduit Corporation.
 - j. Wheatland Tube Company.
 2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 3. GRC: Comply with ANSI C80.1 and UL 6.
 4. IMC: Comply with ANSI C80.6 and UL 1242.
 5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - a. Comply with NEMA RN 1.
 - b. Coating Thickness: 0.040 inch (1 mm), minimum.
 6. EMT: Comply with ANSI C80.3 and UL 797.
 7. FMC: Comply with UL 1; zinc-coated steel.
 8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- B. Metal Fittings:
1. 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:
 - a. AFC Cable Systems; a part of Atkore International.
 - b. Allied Tube & Conduit; a part of Atkore International.
 - c. Anamet Electrical, Inc.
 - d. FSR Inc.
 - e. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - f. Thomas & Betts Corporation; A Member of the ABB Group.
 - g. Western Tube and Conduit Corporation.
 - h. Wheatland Tube Company.
 2. Comply with NEMA FB 1 and UL 514B.
 3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 4. Fittings, General: Listed and labeled for type of conduit, location, and use.
 5. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 6. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew or compression.
 7. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

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8. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

- C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. 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:
 - a. AFC Cable Systems; a part of Atkore International.
 - b. Arnco Corporation.
 - c. CANTEX INC.
 - d. Electri-Flex Company.
 - e. RACO; Hubbell.
 - f. Thomas & Betts Corporation; A Member of the ABB Group.
2. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
4. LFNC: Comply with UL 1660.
5. RTRC: Comply with UL 2515A and NEMA TC 14.

B. Nonmetallic Fittings:

1. 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:
 - a. AFC Cable Systems; a part of Atkore International.
 - b. Arnco Corporation.
 - c. CANTEX INC.
 - d. FRE Composites.
 - e. RACO; Hubbell.
 - f. Thomas & Betts Corporation; A Member of the ABB Group.
2. Fittings, General: Listed and labeled for type of conduit, location, and use.
3. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
 - a. Fittings for LFNC: Comply with UL 514B.
4. Solvents and Adhesives: As recommended by conduit manufacturer.

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. B-line, an Eaton business.

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2. Hoffman; a brand of Pentair Equipment Protection.
3. MonoSystems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 3R unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.04 BOXES, ENCLOSURES, AND CABINETS

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. Adalet.
2. Crouse-Hinds, an Eaton business.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman; a brand of Pentair Equipment Protection.
7. Hubbell Incorporated.
8. Hubbell Incorporated; Wiring Device-Kellems.
9. Kraloy.
10. MonoSystems, Inc.
11. Oldcastle Enclosure Solutions.
12. O-Z/Gedney; a brand of Emerson Industrial Automation.
13. RACO; Hubbell.
14. Spring City Electrical Manufacturing Company.
15. Thomas & Betts Corporation; A Member of the ABB Group.
16. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal pressed Outlet and Device Boxes with not welded edges: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

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- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Metal Floor Boxes:
 - 1. Multi-service flush mounted floor box with UL scrub water approved.
 - a. Material: Cast metal.
 - b. Type: Fully adjustable.
 - c. Shape: Rectangular.
 - d. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Recessed multi-service flush mounted box with hinged cover and cord access flap with UL scrub water approved label..
 - a. Material: Cast metal.
 - b. Type: Fully adjustable.
 - c. Shape: Rectangular.
 - d. Size: 10"x12"x6" Deep
 - e. Knock –out fittings: (8) ¾", (12) concentric 1"/1¼"/1½"
 - f. Cover:: Cover with brass carpet flange, life off door and UL scrube water rated for tile and carpet installation, coordinate brass flange height with architect
- G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.
- J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- L. Gangable boxes are prohibited.
- M. Cabinets:
 - 1. NEMA 250, Type 1 or Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.

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2.05 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 1. 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:
 - a. Armorcast Products Company.
 - b. NewBasis.
 - c. Oldcastle Enclosure Solutions.
 - d. Oldcastle Precast, Inc.
 - e. Quazite: Hubbell Power Systems, Inc.
 2. Standard: Comply with SCTE 77.
 3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 6. Cover Legend: Molded lettering, "ELECTRIC."
 7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 8. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.06 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 1. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 EXECUTION

3.01 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: GRC IMC EMT.

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3. Underground Branch Conduit: RNC, Type EPC-40-PVC, direct buried.
 4. Underground Feeder Conduit: Type EPC-40-PVC, concrete encased where indicated on plans.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 6. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
 - a. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - b. Mechanical rooms.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: IMC.
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Interior Raceway Size: 3/4-inch (21-mm) trade size.
- D. Greenhouse: PVC coated steel conduits, fittings and boxes.
- E. Minimum Exterior Raceway Size: 1-1/4"inch (32-mm) trade size.
- F. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- G. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

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3.02 RACEWAY SEPARATION OF SYSTEM WIRING

- A. Provide minimum separations between power and wiring and signal system wiring as indicated in table below. Where minimum separation can not be maintained due to existing conditions obtain written permission for closer spacing.

	Power Raceways (70 Volts or More)	Transformers, Motors and Motor Starters	Power Raceways with Dimming Circuits	Lighting Fixtures
Telephone	5"	12"	24"	12"
DATA	5"	12"	24"	12"
Paging / Sound	5"	12"	24"	5"
Security	5"	12"	24"	5"
CCTV	5"	12"	24"	5"
Monitoring and Control	5"	12"	24"	5"
Fire Alarm	5"	12"	24"	5"
Cable Tray	12"	24"	24"	12"

3.03 INSTALLATION

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

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- F. Complete raceway installation before starting conductor installation.
- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- H. Install, for 70 volt and above, no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- I. Install, for below 70 volt raceways, no more than the equivalent of two 90-degree bends in any conduit run. Support within 12 inches (300 mm) of changes in direction.
- J. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- K. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- L. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- M. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from RNC, Type EPC-40-PVC, to GRC before rising above floor.
- N. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- O. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- P. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- Q. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat

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metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

- R. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- S. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- T. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- U. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- V. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- W. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Conduit extending from interior to exterior of building.
 - 4. Conduit extending into pressurized duct and equipment.
 - 5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 - 6. Where otherwise required by NFPA 70.
- X. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- Y. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - b. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.

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- c. Attics: 135 deg F (75 deg C) temperature change.
- 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
- 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
- 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Z. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC in damp or wet locations not subject to severe physical damage.
- AA. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- BB. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- CC. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- DD. Locate boxes so that cover or plate will not span different building finishes.
- EE. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- GG. Set metal floor boxes level and flush with finished floor surface.
- HH. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- II. to be used, and seal around penetrations after fittings are installed.

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3.04 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A.** Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.05 FIRESTOPPING

- A.** Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078400 "Penetration Firestopping."

3.06 PROTECTION

- A.** Protect coatings, finishes, and cabinets from damage and deterioration.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

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SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.
 2. Rigid nonmetallic duct.
 3. Duct accessories.
 4. Precast concrete handholes.
 5. Polymer concrete handholes and boxes with polymer concrete cover.
 6. Fiberglass handholes and boxes with polymer concrete cover.
 7. Fiberglass handholes and boxes.
 8. High-density plastic boxes.

1.02 DEFINITIONS

- A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.
- B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.
- C. Duct Bank:
1. Two or more ducts installed in parallel, with or without additional casing materials.
 2. Multiple duct banks.
- D. GRC: Galvanized rigid (steel) conduit.
- E. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For duct and duct bank. Show duct profiles and coordination with other utilities and underground structures.
1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
 2. Drawings shall be signed and sealed by a qualified professional engineer.
- B. Field quality-control reports.

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1.04 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Owner's written permission.
- B. Ground Water: Assume ground-water level is 36 inches (900 mm) below ground surface unless a higher water table is noted on Drawings.

PART 2 PRODUCTS

2.01 METAL CONDUIT AND FITTINGS

- A. GRC: Comply with ANSI C80.1 and UL 6.
- B. Coated Steel Conduit: PVC-coated GRC.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- C. 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. AFC Cable Systems; a part of Atkore International.
 - 2. Allied Tube & Conduit; a part of Atkore International.
 - 3. Anamet Electrical, Inc.
 - 4. Calconduit.
 - 5. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 6. Republic Conduit.
- D. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.02 RIGID NONMETALLIC DUCT

- A. Underground Plastic Utilities Duct: Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.>
- B. 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. ARNCO Corp.
 - 2. CANTEX INC.
 - 3. Condux International, Inc.
 - 4. Crown Line Plastics.
 - 5. Electri-Flex Company.
 - 6. National Pipe & Plastics.

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- C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
- D. Solvents and Adhesives: As recommended by conduit manufacturer.

2.03 DUCT ACCESSORIES

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
 - 1. 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:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. CANTEX INC.
 - c. Carlon; a brand of Thomas & Betts Corporation.
 - d. IPEX USA LLC.
 - e. PenCell Plastics.
 - f. Underground Devices, Inc.
- B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

2.04 PRECAST CONCRETE HANDHOLES AND BOXES

- A. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
- B. 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. Christy Concrete Products.
 - 2. Oldcastle Precast, Inc.
 - 3. Utility Concrete Products, LLC.
 - 4. Utility Vault Co.
- C. Comply with ASTM C 858 for design and manufacturing processes.
- D. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
- E. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- F. Cover Legend: Molded lettering, as indicated for each service.
- G. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

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- H. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
 - 1. Extension shall provide increased depth of 12 inches (300 mm).
 - 2. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
- I. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
- J. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.
 - 1. Knockout panels shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
 - 2. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.
 - 3. Knockout panels shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
 - 4. Knockout panels shall be 1-1/2 to 2 inches (38 to 50 mm) thick.
- K. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.05 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER

- A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
- B. 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. Armorcast Products Company.
 - 2. NewBasis.
 - 3. Oldcastle Enclosure Solutions.
- C. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- D. Color: Gray.
- E. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
- F. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- G. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

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- H. Cover Legend: Molded lettering, as indicated for each service.
- I. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
- J. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have factory-installed inserts for cable racks and pulling-in irons.

2.06 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C 1037.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.
- C. Clear and grub vegetation to be removed, and protect vegetation to remain according to Section 311000 "Site Clearing." Remove and stockpile topsoil for reapplication according to Section 311000 "Site Clearing."

3.02 UNDERGROUND DUCT APPLICATION

IG Engineer – Consider HDPE instead of PVC for projects with sustainable goals.

- A. Duct for Electrical Cables More Than 600 V: Type EPC-80-PVC RNC, concrete-encased unless otherwise indicated.
- B. Duct for Electrical Feeders 600 V and Less: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated.
- C. Duct for Electrical Branch Circuits: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated.
- D. Bored Underground Duct: Type EPEC-80-HDPE unless otherwise indicated.

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- E. Underground Ducts Crossing Paved Paths and Driveways Roadways and Railroads: Type EPC-80 PVC RNC, encased in reinforced concrete.
- F. Stub-ups: Concrete-encased GRC.

3.03 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less:
 - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
 - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
 - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.
 - 4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.
 - 5. Cover design load shall not exceed the design load of the handhole or box.

3.04 EARTHWORK

- A. Excavation and Backfill: Comply with Section 312333 "Trenching, Backfilling, and Compacting" but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restoration: Replace area after construction vehicle traffic in immediate area is complete.
- C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Turf and Grasses" and Section 329300 "Plants."
- E. Cut and patch existing pavement in the path of underground duct, duct bank, and underground structures according to "Cutting and Patching" Article in Section 017329 "Cutting and Patching."

3.05 DUCT AND DUCT-BANK INSTALLATION

- A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
- B. Install duct according to NEMA TCB 2.
- C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.

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- D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 12.5 feet (4 m), both horizontally and vertically, at other locations unless otherwise indicated.
- E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.
- F. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing the duct will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.
- G. End Bell Entrances to Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) duct, and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell, without reducing duct slope and without forming a trap in the line.
 - 2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct with calculated expansion of more than 3/4 inch (19 mm).
- H. Terminator Entrances to Concrete and Polymer Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inches (150 mm) o.c. for 4-inch (100-mm) duct, and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to terminator spacing 10 feet (3 m) from the terminator, without reducing duct line slope and without forming a trap in the line.
 - 2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line duct with calculated expansion of more than 3/4 inch (19 mm).
- I. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet (3 m) outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition. Install GRC penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- J. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.
- K. Pulling Cord: Install 200-lbf- (1000-N-) test nylon cord in empty ducts.
- L. Concrete-Encased Ducts and Duct Bank:

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1. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 312333 "Trenching, Backfilling, and Compacting" for pipes less than 6 inches (150 mm) in nominal diameter.
2. Width: Excavate trench 3 inches (75 mm) wider than duct on each side.
3. Depth: Install so top of duct envelope is at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
4. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
5. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than five spacers per 20 feet (6 m) of duct. Place spacers within 24 inches (600 mm) of duct ends. Stagger spacers approximately 6 inches (150 mm) between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
6. Minimum Space between Duct: 3 inches (75 mm) between edge of duct and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and communications ducts.
7. Elbows: Use manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct unless otherwise indicated. Extend encasement throughout length of elbow.
8. Elbows: Use manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct run.
 - a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
 - b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.
 - 1) Stub-ups shall be minimum 4 inches (100 mm) above finished floor and minimum 3 inches (75 mm) from conduit side to edge of slab.
 - c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches (1500 mm) from edge of wall. Install insulated grounding bushings on terminations at equipment.
 - 1) Stub-ups shall be minimum 4 inches (100 mm) above finished floor and no less than 3 inches (75 mm) from conduit side to edge of slab.
9. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
10. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
11. Concrete Cover: Install a minimum of 3 inches (75 mm) of concrete cover between edge of duct to exterior envelope wall, 2 inches (50 mm) between duct of like services, and 4 inches (100 mm) between power and communications ducts.
12. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. Start at one end and finish at the other, allowing for expansion and contraction of duct as its temperature changes during and after the pour. Use expansion fittings

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installed according to manufacturer's written instructions, or use other specific measures to prevent expansion-contraction damage.

- b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (15-mm) reinforcing-rod dowels extending a minimum of 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.
13. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.
- M. Direct-Buried Duct and Duct Bank:
1. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches (150 mm) in nominal diameter.
 2. Width: Excavate trench 12 inches (300 mm) wider than duct on each side.
 3. Depth: Refer to details.
 4. Set elevation of bottom of duct bank below frost line.
 5. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
 6. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than five spacers per 20 feet (6 m) of duct. Place spacers within 24 inches (600 mm) of duct ends. Stagger spacers approximately 6 inches (150 mm) between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 7. Install duct with a minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and communications duct.
 8. Elbows: Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
 9. Install manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct.
 - a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
 - b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.
 - 1) Stub-ups shall be minimum 4 inches (100 mm) above finished floor and minimum 3 inches (75 mm) from conduit side to edge of slab.
 - c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches (1500 mm) from edge of wall. Install insulated grounding bushings on terminations at equipment.
 - 1) Stub-ups shall be minimum 4 inches (100 mm) above finished floor and no less than 3 inches (75 mm) from conduit side to edge of slab.
 10. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction

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as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches (100 mm) over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.

- a. Place minimum 6 inches (150 mm) of engineered fill above concrete encasement of duct.

- N. Underground-Line Warning Tape: Bury conducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inches (300 mm) above all concrete-encased duct and duct banks and approximately 12 inches (300 mm) below grade. Align tape parallel to and within 3 inches (75 mm) of centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

3.06 INSTALLATION OF CONCRETE HANDHOLES, AND BOXES

- A. Precast Concrete Handhole and Manhole Installation:
 1. Comply with ASTM C 891 unless otherwise indicated.
 2. Install units level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances.
 3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- B. Elevations:
 1. Install handholes with bottom below frost line, below grade.
 2. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
 3. Where indicated, cast handhole cover frame integrally with handhole structure.
- C. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.
- D. Dampproofing: Apply dampproofing to exterior surfaces of manholes after concrete has cured at least three days. Dampproofing materials and installation are specified in Section 071113 "Bituminous Dampproofing." After ducts are connected and grouted, and before backfilling, dampproof joints and connections, and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.
- E. Field-Installed Bolting Anchors in Concrete Handholes: Do not drill deeper than 3-7/8 inches (97 mm) for manholes and 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

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3.07 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
- D. Install handholes and boxes with bottom below frost line, below grade.
- E. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- F. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
 1. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Section 033000 "Cast-in-Place Concrete," with a troweled finish.
 2. Dimensions: 10 inches wide by 12 inches deep (250 mm wide by 300 mm deep)]

3.08 GROUNDING

- A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.09 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch- (300-mm-) long mandrel equal to duct size minus 1/4 inch (6 mm). If obstructions are indicated, remove obstructions and retest.
 3. Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

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- C. Prepare test and inspection reports.

3.10 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump.
1. Sweep floor, removing dirt and debris.
 2. Remove foreign material.

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SECTION 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.
- B. Related Requirements:
 - 1. Section 078400 "Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

PART 2 PRODUCTS

2.01 SLEEVES

- A. Wall Sleeves:
 - 1. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.02 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

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1. 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:

- a. HOLDRITE.

2.03 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.

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2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. 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.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

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SECTION 26 05 48.16 - SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Restraint channel bracings.
 - 2. Restraint cables.
 - 3. Seismic-restraint accessories.
 - 4. Mechanical anchor bolts.
 - 5. Adhesive anchor bolts.
- B. Related Requirements:
 - 1. Section 260529 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. 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.
- B. Delegated-Design Submittal: For each seismic-restraint device.
 - 1. Include design calculations and details for selecting 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 caused by equipment weight, operation, and seismic and wind forces required to select seismic and wind restraints and for designing vibration isolation bases.
 - 3. Seismic- and Wind-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic and wind 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.

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- 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).

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints. Electrical components include:
1. Control and monitoring panels.
 2. Generators.
 3. Luminaires.
 4. Panelboards.
 5. Switchboards.
 6. Transformers.
- B. Qualification Data: For professional engineer and testing agency.
- C. Field quality-control reports.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated 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. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval from OSHPD in addition to preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. 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) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
1. Basic Wind Speed: ASCE/SEI 7 or Structural Engineer
 2. Building Classification Category: ASCE/SEI 7 or Structural Engineer.
 3. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by maximum area of component projected on vertical plane normal to wind direction and 45 degrees either side of normal.

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- B. Seismic-Restraint Loading:
1. Site Class as Defined in the IBC: ASCE/SEI 7 or Structural Engineer
 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: ASCE/SEI 7 or Structural Engineer
 - a. Component Importance Factor: [1.0] [1.5] <Insert value>.
 - b. Component Response Modification Factor: [1.5] [2.5] [3.5] [5.0] <Insert value>.
 - c. Component Amplification Factor: [1.0] [2.5] <Insert value>.
 3. Design Spectral Response Acceleration at Short Periods (0.2 Second): <Insert percentage>.
 4. Design Spectral Response Acceleration at 1.0-Second Period: <Insert percentage>.

2.02 RESTRAINT CHANNEL BRACINGS

- 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. B-line, an Eaton business.
 2. Hilti, Inc.
 3. Mason Industries, Inc.
 4. Unistrut; Part of Atkore International.
- B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.03 RESTRAINT CABLES

- 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. Kinetics Noise Control, Inc.
 2. Vibration & Seismic Technologies, LLC.
 3. Vibration Mountings & Controls, Inc.
- B. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.04 SEISMIC-RESTRAINT ACCESSORIES

- 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. B-line, an Eaton business.
 2. Kinetics Noise Control, Inc.
 3. Mason Industries, Inc.

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- B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. 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.
- E. 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.
- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.05 MECHANICAL ANCHOR BOLTS

- 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. B-line, an Eaton business.
 - 2. Hilti, Inc.
 - 3. Kinetics Noise Control, Inc.
 - 4. Mason Industries, Inc.
- B. 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.

PART 3 EXECUTION

3.01 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. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

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- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners to prevent buckling of hanger rods caused by 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.

3.03 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. Equipment and Hanger Restraints:
 - 1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. 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.
- E. 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.
- F. 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.

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3.04 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.05 FIELD QUALITY CONTROL

- A. Perform the following 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.
- B. Seismic controls will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.06 ADJUSTING

- A. Adjust restraints to permit free movement of equipment within normal mode of operation.

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SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
 - 2. Labels.
 - 3. Tapes and stencils.
 - 4. Signs.
 - 5. Cable ties.
 - 6. Paint for identification.
 - 7. Fasteners for labels and signs.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 70.
- B. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- C. Comply with ANSI Z535.4 for safety signs and labels.
- D. Comply with NFPA 70E and Section 260574 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
 - 1. Color shall be factory applied.
 - 2. Colors for 208/120-V Circuits:

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- a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
- 3. Color for Neutral: White or gray.
- 4. Color for Equipment Grounds: Green.
- 5. Colors for Isolated Grounds: Green with white stripe.
- C. Raceways and Cables Carrying Circuits at More Than 600 V:
 - 1. Black letters on an orange field.
 - 2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."
- D. Warning Label Colors:
 - 1. Identify system voltage with black letters on an orange background.
- E. Warning labels and signs shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
- F. Equipment Identification Labels:
 - 1. Black letters on a white field.

2.03 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
 - 1. 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:
 - a. Brady Corporation.
 - b. Panduit Corp.
 - c. Seton Identification Products.
- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
 - 1. 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:
 - a. Brady Corporation.
 - b. Panduit Corp.
 - c. Seton Identification Products.

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- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
1. 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:
 - a. Brady Corporation.
 - b. Brother International Corporation.
 - c. Ideal Industries, Inc.
 - d. Panduit Corp.
 - e. Seton Identification Products.
 2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
 3. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Polyester thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
1. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches (37 by 150 mm)for raceway and conductors.
 - b. 3-1/2 by 5 inches (76 by 127 mm)for equipment.
 - c. As required by authorities having jurisdiction.

2.04 TAPES AND STENCILS

- A. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.
1. 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:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. Marking Services, Inc.
- B. Tape and Stencil: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background and is 12 inches (300 mm) wide. Stop stripes at legends.
1. 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:

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- a. LEM Products Inc.
 - b. Marking Services, Inc.
 - c. Seton Identification Products.

- C. Floor Marking Tape: 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
 - 1. 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:
 - a. Carlton Industries, LP.
 - b. Seton Identification Products.

- D. Underground-Line Warning Tape:
 - 1. 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:
 - a. Brady Corporation.
 - b. Ideal Industries, Inc.
 - c. Marking Services, Inc.
 - d. Seton Identification Products.
 - 2. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 - 3. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
 - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
 - 4. Tag: :
 - a. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Width: 3 inches (75 mm).
 - c. Overall Thickness: 8 mils (0.2 mm).
 - d. Foil Core Thickness: 0.35 mil (0.00889 mm).

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- e. Weight: 34 lb/1000 sq. ft. (16.6 kg/100 sq. m).
- f. Tensile according to ASTM D 882: 300 lbf (1334 N) and 12,500 psi (86.1 MPa).

- E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.05 SIGNS

A. Baked-Enamel Signs:

- 1. 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:
 - a. Carlton Industries, LP.
 - b. Marking Services, Inc.
- 2. Preprinted aluminum signs, [high-intensity reflective,]punched or drilled for fasteners, with colors, legend, and size required for application.
- 3. 1/4-inch (6.4-mm) grommets in corners for mounting.
- 4. Nominal Size: 7 by 10 inches (180 by 250 mm).

B. Laminated Acrylic or Melamine Plastic Signs:

- 1. 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:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. Marking Services, Inc.
- 2. Engraved legend.
- 3. Thickness:
 - a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
 - b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
 - c. Engraved legend with black letters on white face.
 - d. Punched or drilled for mechanical fasteners with 1/4-inch (6.4-mm) grommets in corners for mounting.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.06 CABLE TIES

- 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:

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1. Ideal Industries, Inc.
2. Marking Services, Inc.
3. Panduit Corp.

- B. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
 1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 7000 psi (48.2 MPa).
 3. UL 94 Flame Rating: 94V-0.
 4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
 5. Color: Black.

2.07 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. **Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.**

PART 3 EXECUTION

3.01 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.02 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

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- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
- M. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- N. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Labels:
 - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
- P. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- Q. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- R. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
- S. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

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- T. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- U. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
 - 2. Install underground-line warning tape for direct-buried cables and cables in raceways.
- V. Baked-Enamel Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.
- W. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.
- X. Cable Ties: General purpose, for attaching tags, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.

3.03 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3-inch- (75-mm-) high, black letters on 20-inch (500-mm) centers.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, and at 10-foot (3-m) maximum intervals.
- D. Accessible Raceways and Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.

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1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- E. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
1. "EMERGENCY POWER."
 2. "POWER."
 3. "FIRE ALARM"
- F. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use snap-around color-coding bands to identify the phase.
1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- G. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.
- H. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.
- I. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.
- J. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- K. Auxiliary Electrical Systems Conductor Identification: Marker tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- L. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- M. Concealed Raceways and Duct Banks, More Than 600 V, within Buildings: Apply floor marking tape to the following finished surfaces:
1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
 2. Wall surfaces directly external to raceways concealed within wall.
 3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

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- N. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- O. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- P. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- Q. Arc Flash Warning Labeling: Self-adhesive labels.
- R. Main Electrical Room: Framed with glass protective cover a full size drawing of project electrical single line diagram including all Project Record changes wall. Where multiple drawings are included in construction documents provide one for each sheet.
- S. Operating Instruction Signs: Self-adhesive labels.
- T. Emergency Operating Instruction Signs: Baked-enamel warning signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.
- U. Equipment Identification Labels:
 - 1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
 - 2. Outdoor Equipment: Stenciled legend 4 inches (100 mm) high.
 - 3. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Switchboards.
 - e. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - f. Emergency system boxes and enclosures.
 - g. Enclosed switches.
 - h. Enclosed circuit breakers.
 - i. Enclosed controllers.
 - j. Variable-speed controllers.
 - k. Push-button stations.
 - l. Power-transfer equipment.
 - m. Contactors.

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- n. Remote-controlled switches, dimmer modules, and control devices.
- o. Battery-inverter units.
- p. Power-generating units.
- q. Monitoring and control equipment.

END OF SECTION

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SECTION 26 05 72 - OVERCURRENT PROTECTIVE DEVICE SHORT-CIRCUIT STUDY

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.02 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- D. SCCR: Short-circuit current rating.
- E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.03 ACTION SUBMITTALS

- A. Product Data: For computer software program to be used for studies.
- B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.
 - 1. Short-circuit study input data, including completed computer program input data sheets.
 - 2. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.
 - a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.
 - b. Revised single-line diagram, reflecting field investigation results and results of short-circuit study.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Short-Circuit Study Specialist.

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- B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.05 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.
- B. Short-Circuit Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- C. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 COMPUTER SOFTWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. SKM Systems Analysis, Inc.
- B. Comply with IEEE 399 and IEEE 551.
- C. Analytical features of fault-current-study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.02 SHORT-CIRCUIT STUDY REPORT CONTENTS

- A. Executive summary.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of the computer printout.
- C. One-line diagram, showing the following:
1. Protective device designations and ampere ratings.
 2. Cable size and lengths.
 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 4. Motor and generator designations and kVA ratings.

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5. Switchgear, switchboard, motor-control center, and panelboard designations.
- D. Comments and recommendations for system improvements, where needed.
- E. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to short-circuit ratings.
 2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
 3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
 5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
- F. Short-Circuit Study Input Data: As described in "Power System Data" Article in the Evaluations.
- G. Short-Circuit Study Output:
1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. Equivalent impedance.
 2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. Calculated asymmetrical fault currents:
 - 1) Based on fault-point X/R ratio.
 - 2) Based on calculated symmetrical value multiplied by 1.6.
 - 3) Based on calculated symmetrical value multiplied by 2.7.
 3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
 - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Obtain all data necessary for the conduct of the study.
 1. Verify completeness of data supplied on the one-line diagram. Call any discrepancies to the attention of Architect.
 2. For equipment provided that is Work of this Project, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
 3. For relocated equipment and that which is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.
- B. Gather and tabulate the following input data to support the short-circuit study. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.
 1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 2. Obtain electrical power utility impedance at the service.
 3. Power sources and ties.
 4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
 5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
 6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
 7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
 8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
 9. Motor horsepower and NEMA MG 1 code letter designation.
 10. Cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

3.02 SHORT-CIRCUIT STUDY

- A. Perform study following the general study procedures contained in IEEE 399.
- B. Calculate short-circuit currents according to IEEE 551.
- C. Base study on the device characteristics supplied by device manufacturer.

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- D. Begin short-circuit current analysis at the service, extending down to the system overcurrent protective devices as follows:
 - 1. To normal system low-voltage load buses where fault current is 10 kA or less.
 - 2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.
- E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- F. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.
 - 1. 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.
- G. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each of the following:
 - 1. Incoming switchgear.
 - 2. Unit substation primary and secondary terminals.
 - 3. Low-voltage switchgear.
 - 4. Control panels.
 - 5. Standby generators and automatic transfer switches.
 - 6. Branch circuit panelboards.
 - 7. Disconnect switches.

3.03 ADJUSTING

- A. Make minor modifications to equipment as required to accomplish compliance with short-circuit study.

3.04 DEMONSTRATION

- A. Train Owner's operating and maintenance personnel in the use of study results.

END OF SECTION

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Issue for Bid		Overcurrent Protective Device Short-Circuit Study

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SECTION 26 05 73 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1.02 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- D. SCCR: Short-circuit current rating.
- E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.03 ACTION SUBMITTALS

- A. Product Data: For computer software program to be used for studies.
- B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.
 - 1. Coordination-study input data, including completed computer program input data sheets.
 - 2. Study and equipment evaluation reports.
 - 3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.
 - a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Coordination Study Specialist Field Adjusting Agency.

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- B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For the overcurrent protective devices to include in emergency, operation, and maintenance manuals.
1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. The following parts from the Protective Device Coordination Study Report:
 - 1) One-line diagram.
 - 2) Protective device coordination study.
 - 3) Time-current coordination curves.
 - b. Power system data.

1.06 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.
- B. Coordination Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- C. Coordination Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

- A. Software Developers:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:

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- a. SKM Systems Analysis, Inc.
- B. Comply with IEEE 242 and IEEE 399.
- C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.
 - 1. Optional Features:
 - a. Arcing faults.
 - b. Simultaneous faults.
 - c. Explicit negative sequence.
 - d. Mutual coupling in zero sequence.

2.02 PROTECTIVE DEVICE COORDINATION STUDY REPORT CONTENTS

- A. Executive summary.
- B. Study descriptions, purpose, basis and scope. Include case descriptions, definition of terms and guide for interpretation of the computer printout.
- C. One-line diagram, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Cable size and lengths.
 - 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center, and panelboard designations.
- D. Study Input Data: As described in "Power System Data" Article.
- E. Short-Circuit Study Output: As specified in "Short-Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260572 "Overcurrent Protective Device Short-Circuit Study."
- F. Protective Device Coordination Study:
 - 1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.
 - a. Phase and Ground Relays:
 - 1) Device tag.
 - 2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
 - 3) Recommendations on improved relaying systems, if applicable.

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- b. Circuit Breakers:
 - 1) Adjustable pickups and time delays (long time, short time, ground).
 - 2) Adjustable time-current characteristic.
 - 3) Adjustable instantaneous pickup.
 - 4) Recommendations on improved trip systems, if applicable.
 - c. Fuses: Show current rating, voltage, and class.
- G. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
 - 1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
 - 2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
 - 3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
 - 4. Plot the following listed characteristic curves, as applicable:
 - a. Power utility's overcurrent protective device.
 - b. Medium-voltage equipment overcurrent relays.
 - c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
 - d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
 - e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
 - f. Cables and conductors damage curves.
 - g. Ground-fault protective devices.
 - h. Motor-starting characteristics and motor damage points.
 - i. Generator short-circuit decrement curve and generator damage point.
 - j. The largest feeder circuit breaker in each motor-control center and panelboard.
 - 5. Series rating on equipment is not allowed.
 - 6. Provide adequate time margins between device characteristics such that selective operation is achieved.
 - 7. Comments and recommendations for system improvements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.
 - 1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

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3.02 PROTECTIVE DEVICE COORDINATION STUDY

- A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.
- B. Comply with IEEE 399 for general study procedures.
- C. The study shall be based on the device characteristics supplied by device manufacturer.
- D. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:
 1. To normal system low-voltage load buses where fault current is 10 kA or less.
 2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.
- E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- F. Transformer Primary Overcurrent Protective Devices:
 1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
- G. Motor Protection:
 1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
 2. Select protection for motors served at voltages more than 600 V according to IEEE 620.
- H. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
- I. Generator Protection: Select protection according to manufacturer's written recommendations and to IEEE 242.
- J. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

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1. 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.
- K. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:
1. Electric utility's supply termination point.
 2. 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. <Insert significant locations in the system>.
- L. 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. Any application of series-rated devices shall be allowed.

3.03 LOAD-FLOW AND VOLTAGE-DROP STUDY

- A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:
1. Determine load-flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
 2. Determine load-flow and voltage drop based on 80 percent of the design capacity of the load buses.
 3. Prepare the load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.04 MOTOR-STARTING STUDY

- A. Perform a motor-starting study to analyze the transient effect of the system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze the effects of the motor starting on the power system stability.
- B. Prepare the motor-starting study report, noting light flicker for limits proposed by IEEE 141, , and voltage sags so as not to affect the operation of other utilization equipment on the system supplying the motor.

3.05 POWER SYSTEM DATA

- A. Obtain all data necessary for the conduct of the overcurrent protective device study.
1. Verify completeness of data supplied in the one-line diagram on Drawings. Call discrepancies to the attention of Architect.

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2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
 3. For existing equipment, whether or not relocated obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.
- B. Gather and tabulate the following input data to support coordination study. The list below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.
1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 2. Electrical power utility impedance at the service.
 3. Power sources and ties.
 4. Short-circuit current at each system bus, three phase and line-to-ground.
 5. Full-load current of all loads.
 6. Voltage level at each bus.
 7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
 8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
 9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
 10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
 11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
 12. Maximum demands from service meters.
 13. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
 14. Motor horsepower and NEMA MG 1 code letter designation.
 15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
 16. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.
 17. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.

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- c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
- d. Generator thermal-damage curve.
- e. Ratings, types, and settings of utility company's overcurrent protective devices.
- f. Special overcurrent protective device settings or types stipulated by utility company.
- g. Time-current-characteristic curves of devices indicated to be coordinated.
- h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
- i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
- j. Panelboards, switchboards, motor-control center ampacity, and SCCR in amperes rms symmetrical.
- k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.06 FIELD ADJUSTING

- A. Adjust relay and protective device settings according to the recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.
- B. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.
 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.07 DEMONSTRATION

- A. Engage the Coordination Study Specialist to train Owner's maintenance personnel in the following:
 1. Acquaint personnel in the fundamentals of operating the power system in normal and emergency modes.
 2. Hand-out and explain the objectives of the coordination study, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting the time-current coordination curves.
 3. Adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION

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SECTION 26 05 74 - OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.02 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- D. SCCR: Short-circuit current rating.
- E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.03 ACTION SUBMITTALS

- A. Product Data: For computer software program to be used for studies.
- B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form.
 - 1. Arc-flash study input data, including completed computer program input data sheets.
 - 2. Arc-flash study report; signed, dated, and sealed by a qualified professional engineer.
 - a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Arc-Flash Study Specialist.

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- B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
1. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.
 2. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.06 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.
- B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- C. Arc-Flash Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

PART 2 PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. SKM Systems Analysis, Inc.
- B. Comply with IEEE 1584 and NFPA 70E.
- C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.02 ARC-FLASH STUDY REPORT CONTENT

- A. Executive summary.

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- B. Study descriptions, purpose, basis and scope.
- C. One-line diagram, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Cable size and lengths.
 - 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center and panelboard designations.
- D. Study Input Data: As described in "Power System Data" Article.
- E. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 260573 "Overcurrent Protective Device Coordination Study."
- F. Arc-Flash Study Output:
 - 1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
 - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.
- G. Incident Energy and Flash Protection Boundary Calculations:
 - 1. Arcing fault magnitude.
 - 2. Protective 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.
- H. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

2.03 ARC-FLASH WARNING LABELS

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch (76-by-127-mm) self-adhesive equipment label for each work location included in the analysis.

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- B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
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-applied markings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.02 ARC-FLASH HAZARD ANALYSIS

- A. Comply with NFPA 70E and its Annex D for hazard analysis study.
- B. Preparatory Studies:
1. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 260573 "Overcurrent Protective Device Coordination Study."
- C. Calculate maximum and minimum contributions of fault-current size.
1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
 2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
- D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.
- E. Include medium- and low-voltage equipment locations, except equipment rated 240-V ac or less fed from transformers less than 125 kVA.
- F. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.
- G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take

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into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash computation shall include both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.03 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on the one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to the attention of Architect.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers.

B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in per cent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating and impedance.

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9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.

3.04 LABELING

- A. Apply one arc-flash label for 600-V ac, 480-V ac, and applicable 208-V ac panelboards and disconnects and for each of the following locations:
 1. Motor-control center.
 2. Low-voltage switchboard.
 3. Switchgear.
 4. Medium-voltage switch.
 5. Control panel.

3.05 APPLICATION OF WARNING LABELS

- A. Install the arc-fault warning labels under the direct supervision and control of the Arc-Flash Study Specialist.

3.06 DEMONSTRATION

- A. Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

END OF SECTION

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SECTION 26 09 23.02 - LIGHTING CONTROL SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Digital Lighting Controls
 - 2. Relay Panels
 - 3. Emergency Lighting Control (if applicable)
- B. Related Sections:
 - 1. Section 26 27 26 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.
 - 2. Section 26 56 19 – LED Exterior Lighting
 - 3. Section 26 51 19 - LED Interior Lighting
- C. Control Intent – Control Intent includes, but is not limited to:
 - 1. Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
 - 2. Initial sensor and switching zones
 - 3. Initial time switch settings
 - 4. Task lighting and receptacle controls
 - 5. Emergency Lighting control (if applicable)

1.02 QUALITY ASSURANCE

- A. Manufacturer: Minimum 10 years experience in manufacture of lighting controls.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Show installation details for the following:
 - a. Occupancy sensors.
 - b. Vacancy sensors.
 - c. Daylighting sensors.
 - d. Inwall controls.
 - 2. Interconnection diagrams showing field-installed wiring.
 - 3. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

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1. Suspended ceiling components.
2. Structural members to which equipment will be attached.
3. Items penetrating finished ceiling, including the following:
 - a. Luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Control modules.
- B. Field quality-control reports.
- C. Sample Warranty: For manufacturer's warranties.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.
- B. Software and Firmware Operational Documentation:
 1. Software operating and upgrade manuals.
 2. Program Software Backup: On manufacturer's website. Provide names, versions, and website addresses for locations of installed software.
 3. Device address list.
 4. Printout of software application and graphic screens.

1.06 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of lighting control software.
 - b. Faulty operation of lighting control devices.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION AND OPERATION

- A. The Lighting Control and Automation system as defined under this section covers the following equipment:
 1. Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
 2. Digital Switches – Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
 3. Digital Daylighting Sensors – Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications can provide switching, bi-level, tri-level or dimming control for daylight harvesting.

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4. Digital Room Controllers – Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
5. Digital Plug-Load Controllers – Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities.
6. Configuration Tools – Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow bi-directional communication of room variables and occupancy sensor settings. Computer software also customizes room settings.
7. Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
8. Digital Lighting Management (DLM) segment network – Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded,) to connect multiple DLM local networks for centralized control
9. Network Bridge – provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS) and automatically creates BACnet objects representative of connected devices.
10. Segment Manager – provides web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.
11. Programming and Configuration software – Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.
12. LMCP Digital Lighting Management Relay Panel – provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS).
13. Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

2.02 LIGHTING CONTROL APPLICATIONS

- A. Unless relevant provisions of the applicable local Energy Codes are more stringent, provide a minimum application of lighting controls as follows:
 1. Space Control Requirements – Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting

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- room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.
2. Bi-Level Lighting – Provide multi-level controls in all spaces except toilet rooms, storerooms, library stacks, or applications where variable dimming is used.
 3. Task Lighting / Plug Loads – Provide automatic shut off of non essential plug loads and task lighting in all spaces except toilet rooms and storerooms. Provide Automatic-ON of plug loads whenever spaces are occupied. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area.
 4. Daylit Areas – Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
 - a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
 - b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
 - c. Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on drawings.
 - d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.
 5. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four (4) pre-set lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to extinguish all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.

2.03 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Watt Stopper; or a comparable product by one of the following:
 1. Cooper Industries, Inc.
 2. Lithonia Lighting; Acuity Brands Lighting, Inc.

2.04 DIGITAL LIGHTING CONTROLS

- A. Furnish the Company's system which accommodates the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories which suit the lighting and electrical system parameters.

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2.05 DIGITAL WALL SWITCH OCCUPANCY SENSORS

- A. Wallbox mounted passive infrared PIR or dual technology (passive infrared and ultrasonic) digital occupancy sensor with 1 or 2 switch buttons.
- B. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
 1. Digital calibration and pushbutton configuration for the following variables:
 - a. Sensitivity – 0-100% in 10% increments
 - b. Time delay – 1-30 minutes in 1 minute increments
 - c. Test mode – Five second time delay
 - d. Detection technology – PIR, Dual Technology activation and/or re-activation.
 - e. Walk-through mode
 - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
 2. Programmable control functionality including:
 - a. Each sensor may be programmed to control specific loads within a local network.
 - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
 - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
 - d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
 - 1) Ultrasonic and Passive Infrared
 - 2) Ultrasonic or Passive Infrared
 - 3) Ultrasonic only
 - 4) Passive Infrared only
 3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
 4. Two RJ-45 ports for connection to DLM local network.
 5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
 6. Device Status LEDs including:
 - a. PIR detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
 7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
 8. Assignment of local buttons to specific loads within the room without wiring or special tools
 9. Manual override of controlled loads.

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10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.
- C. BACnet object information shall be available for the following objects:
 1. Detection state
 2. Occupancy sensor time delay
 3. Occupancy sensor sensitivity, PIR and Ultrasonic
 4. Button state
 5. Switch lock control
 6. Switch lock status
 - D. Units shall not have any dip switches or potentiometers for field settings.
 - E. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
 - F. Two-button wall switch occupancy sensors, when connected to a single relay dimming room controller, shall operate in the following sequence as a factory default:
 1. Left button
 - a. Press and release - Turn load on
 - b. Press and hold - Raise dimming load
 2. Right button
 - a. Press and release - Turn load off
 - b. Press and hold - Lower dimming load
 - G. Low voltage momentary pushbuttons shall include the following features:
 1. Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - b. Dim locator level indicates power to switch
 - c. Bright status level indicates that load or scene is active
 2. The following button attributes may be changed or selected using a wireless configuration tool:
 - a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
 - b. Individual button function may be configured to Toggle, On only or Off only.
 - c. Individual scenes may be locked to prevent unauthorized change.
 - d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
 - e. Ramp rate may be adjusted for each dimmer switch.
 - f. Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.
 - H. WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

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2.06 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

- A. Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor.
- B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
 1. Digital calibration and pushbutton configuration for the following variables:
 - a. Sensitivity – 0-100% in 10% increments
 - b. Time delay – 1-30 minutes in 1 minute increments
 - c. Test mode – Five second time delay
 - d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
 - e. Walk-through mode
 - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
 2. Programmable control functionality including:
 - a. Each sensor may be programmed to control specific loads within a local network.
 - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
 - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
 - d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
 - 1) Ultrasonic and Passive Infrared
 - 2) Ultrasonic or Passive Infrared
 - 3) Ultrasonic only
 - 4) Passive Infrared only
 3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
 4. One or two RJ-45 port(s) for connection to DLM local network.
 5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
 6. Device Status LEDs, which may be disabled for selected applications, including:
 - a. PIR detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
 7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
 8. Manual override of controlled loads.
 9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

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- C. BACnet object information shall be available for the following objects:
 - 1. Detection state
 - 2. Occupancy sensor time delay
 - 3. Occupancy sensor sensitivity, PIR and Ultrasonic
- D. Units shall not have any dip switches or potentiometers for field settings.
- E. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
- F. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.07 DIGITAL WALL SWITCHES

- A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
 - 1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
 - 2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
 - 3. Configuration LED on each switch that blinks to indicate data transmission.
 - 4. Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - b. Dim locator level indicates power to switch
 - c. Bright status level indicates that load or scene is active
 - 5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
 - 6. Programmable control functionality including:
 - a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
 - b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
 - 7. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
- B. BACnet object information shall be available for the following objects:
 - 1. Button state
 - 2. Switch lock control
 - 3. Switch lock status
- C. Two RJ-45 ports for connection to DLM local network.
- D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

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- E. The following switch attributes may be changed or selected using a wireless configuration tool:
1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
 2. Individual button function may be configured to Toggle, On only or Off only.
 3. Individual scenes may be locked to prevent unauthorized change.
 4. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
 5. Ramp rate may be adjusted for each dimmer switch.
 6. Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.
- F. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.08 DIGITAL DAYLIGHTING SENSORS

- A. Digital daylighting sensors shall work with room controllers to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to a room controller. Daylighting sensors shall be interchangeable without the need for rewiring.
1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
 2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
 3. Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone.
- B. Digital daylighting sensors shall include the following features:
1. The sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
 2. Sensor light level range shall be from 1-6,553 footcandles (fc).
 3. The capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
 4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
 5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
 6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.

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7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
 8. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
 9. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
 10. Configuration LED status light on device that blinks to indicate data transmission.
 11. Status LED indicates test mode, override mode and load binding.
 12. Recessed switch on device to turn controlled load(s) ON and OFF.
 13. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
 - a. Light level
 - b. Day and night setpoints
 - c. Off time delay
 - d. On and off setpoints
 - e. Up to three zone setpoints
 - f. Operating mode – on/off, bi-level, tri-level or dimming
 14. One RJ-45 port for connection to DLM local network.
 15. A choice of accessories to accommodate multiple mounting methods and building materials. The photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62" thickness (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62"-1.25" thickness (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.
 16. Any load or group of loads in the room can be assigned to a daylighting zone
 17. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
 18. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.
- C. Closed loop digital photosensors shall include the following additional features:
1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
 2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
 3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
 4. WattStopper Product Number: LMLS-400, LMLS-400-L.
- D. Open loop digital photosensors shall include the following additional features:

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1. An internal photodiode that measures light in a 60-degree angle cutting off the unwanted light from the interior of the room.
 2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
 3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
 4. WattStopper Product Number: LMLS-500, LMLS-500-L.
- E. Dual loop digital photosensors shall include the following additional features:
1. Close loop portion of dual loop device must have an internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from sources outside of this con
 2. Open loop portion of dual loop device must have an internal photodiode that can measure light in a 60 degree angle, cutting off the unwanted light from the interior of the room.
 3. Automatically establishes application-specific set-points following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of load.
 4. Device must reference closed loop photosensor information as a base line reference. The device must be able to analyze the open loop photosensor information to determine if an adjustment in light levels is required.
 5. Device must be able to automatically commission setpoints each night to provide adjustments to electrical lighting based on changes in overall lighting in the space due to changes in reflectance within the space or changes to daylight contribution based on seasonal changes.
 6. Device must include extendable mounting arm to properly position sensor within a skylight well.
 7. WattStopper product number LMLS-600

2.09 DIGITAL ROOM CONTROLLERS AND PLUG-LOAD CONTROLLERS

- A. Digital controllers for lighting and plug loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room and plug load controllers shall be provided to match the room lighting and plug load control requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications. The control units will include the following features:
1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
 2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf.
 3. Multiple room controllers connected together in a local network must automatically prioritize each room controller, without requiring any configuration or setup, so that

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loads are sequentially assigned using room controller device ID's from highest to lowest.

4. Device Status LEDs to indicate:
 - a. Data transmission
 - b. Device has power
 - c. Status for each load
 - d. Configuration status
5. Quick installation features including:
 - a. Standard junction box mounting
 - b. Quick low voltage connections using standard RJ-45 patch cable
6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
 - a. Turn on to 100%
 - b. Remain off
 - c. Turn on to last level
7. Each load shall be configurable to operate in the following sequences based on occupancy:
 - a. Auto-on/Auto-off (Follow on and off)
 - b. Manual-on/Auto-off (Follow off only)
8. The polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
9. BACnet object information shall be available for the following objects:
 - a. Load status
 - b. Electrical current
 - c. Total watts per controller
 - d. Schedule state – normal or after-hours
 - e. Demand response control and cap level
 - f. Room occupancy status
 - g. Total room lighting and plug loads watts
 - h. Total room watts/sq ft
 - i. Force on/off all loads
10. UL 2043 plenum rated
11. Manual override and LED indication for each load
12. Dual voltage (120/277 VAC, 60 Hz), or 347 VAC, 60 Hz (selected models only). 120/277 volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); 347 volt models rated for 15A total load; plug load controllers carry application-specific UL 20 rating for receptacle control.
13. Zero cross circuitry for each load
14. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.

B. On/Off Room Controllers shall include:

1. One or two relay configuration
2. Efficient 150 mA switching power supply
3. Three RJ-45 DLM local network ports with integral strain relief and dust cover
4. WattStopper product numbers: LMRC-101, LMRC-102

C. On/Off/Dimming enhanced Room Controllers shall include:

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1. Real time current monitoring
2. Multiple relay configurations
 - a. One, two or three relays (LMRC-21x series)
 - b. One or two relays (LMRC-22x series)
3. Efficient 250 mA switching power supply
4. Four RJ-45 DLM local network ports with integral strain relief and dust cover
5. One dimming output per relay
 - a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting. (LMRC-21x series)
 - b. Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads. (LMRC-22x series)
 - c. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.
 - d. The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
 - e. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim.
 - f. Calibration and trim levels must be set per output channel.
 - g. Devices that set calibration or trim levels per controller are not acceptable.
 - h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.
6. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
7. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
8. The following dimming attributes may be changed or selected using a wireless configuration tool:
 - a. Establish preset level for each load from 0-100%
 - b. Set high and low trim for each load
 - c. Set lamp burn in time for each load up to 100 hours
9. Override button for each load provides the following functions:
 - a. Press and release for on/off control
 - b. Press and hold for dimming control
10. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213, LMRC-221, LMRC-222

D. Plug Load Room Controllers shall include:

1. One relay configuration with additional connection for unswitched load
2. Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute

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- occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).
3. Factory default operation is Auto-on/Auto-off, based on occupancy
 4. Real time current monitoring of both switched and un-switched load (LMPL-201 only)
 5. Efficient switching power supply
 - a. 150mA (LMPL-101)
 - b. 250mA (LMPL-201)
 6. RJ-45 DLM local network ports
 - a. Three RJ-45 ports (LMPL-101)
 - b. Four RJ-45 ports (LMPL-201)
 7. WattStopper product numbers: LMPL-101, LMPL-201.

2.10 DLM LOCAL NETWORK (Room Network)

- A. The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
- B. Features of the DLM local network include:
 1. Plug n' Go® automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
 2. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.
 3. Push n' Learn® configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
 4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
- C. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.
- D. If manufacturer's pre-terminated Cat 5e cables are not used for the installation, the contractor is responsible for testing each cable following installation and supplying manufacturer with test results.
- E. WattStopper Product Number: LMRJ-Series

2.11 DLM SEGMENT NETWORK (Room to Room Network)

- A. The segment network shall be a linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control.

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1. Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network.
2. Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections.
3. The segment network shall utilize 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. The maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.
4. Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device.
5. Substitution of manufacturer-supplied cable must be pre-approved: Manufacturer will not certify network reliability, and reserves the right to void warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.
6. Segment networks shall be capable of connecting to BACnet-compliant BAS (provided by others) either directly, via MS/TP, or through NB-ROUTERS, via BACnet/IP or BACnet/Ethernet. Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable.

B. WattStopper Product Number: LM-MSTP, LM-MSTP-DB

2.12 CONFIGURATION TOOLS

- A. A wireless configuration tool facilitates optional customization of DLM local networks using two-way infrared communications, while PC software connects to each local network via a USB interface.
- B. Features and functionality of the wireless configuration tool shall include but not be limited to:
 1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
 2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
 3. Must be able to read and modify parameters for room controllers, occupancy sensors, wall switches, daylighting sensors, network bridges and relay panels, and identify room devices by type and serial number.
 4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
 5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
 6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
 7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
 8. Verify status of building level network devices.

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C. WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

2.13 NETWORK BRIDGE

A. The network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. The network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.

1. The network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
2. Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
3. The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM room devices on each local network. BACnet objects will be created for the addition or replacement of any given in-room DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
 - a. Read/write the normal or after hours schedule state for the room
 - b. Read the detection state of each occupancy sensor
 - c. Read the aggregate occupancy state of the room
 - d. Read/write the On/Off state of loads
 - e. Read/write the dimmed light level of loads
 - f. Read the button states of switches
 - g. Read total current in amps, and total power in watts through the room controller
 - h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
 - i. Activate a preset scene for the room
 - j. Read/write daylight sensor fade time and day and night setpoints
 - k. Read the current light level, in footcandles, from interior and exterior photosensors and photocells
 - l. Set daylight sensor operating mode
 - m. Read/write wall switch lock status
 - n. Read watts per square foot for the entire controlled room
 - o. Write maximum light level per load for demand response mode
 - p. Read/write activation of demand response mode for the room
 - q. Activate/restore demand response mode for the room

B. WattStopper product numbers: LMBC-300

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2.14 SEGMENT MANAGER

- A. For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256 bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443).
- B. Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manger via external routers and switches, using standard Ethernet structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the plans.
- C. Operational features of the Segment Manager shall include the following:
 1. Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.
 2. Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. Shall not require installation of any lighting control software to an end-user PC.
 3. Log in security capable of restricting some users to view-only or other limited operations.
 4. Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not be required to provide communication, monitoring or control of all local networks and lighting control panels.
 5. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.
 6. Ability to view and modify room device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On.
 7. Ability to set up schedules for rooms and panels, view and override current status of panel channels and relays, and assign relays to groups. Schedules shall automatically set controlled zones or areas to either a normal hours or after hours mode of operation. Support for a minimum of 100 unique schedules, each with up to four time events per day. Support for annual schedules, holiday schedules and unique date-bound schedules.
 8. Ability to group rooms and loads for common control by schedules, switches or network commands.
 9. Ability to monitor connected load current and display power consumption for areas equipped with room controllers incorporating the integral current monitoring feature.
 10. Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load

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power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control.

11. The Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable.

- D. Segment Manager shall support multiple DLM rooms as follows:
 1. Support up to 120 network bridges and 900 digital in-room devices (LMSM-3E).
 2. Support up to 300 network bridges and 2,200 digital in room devices, connected via network routers and switches (LMSM-6E).
- E. WattStopper Product Numbers: LMSM-3E, LMSM-6E, NB-ROUTER, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16.

2.15 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

- A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.
 1. Additional parameters exposed through this method include but are not limited to:
 - a. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
 - b. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
 - c. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
 - d. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
 - e. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
 - f. Load control polarity reversal so that on events turn loads off and vice versa.
 - g. Per-load DR (demand response) shed level in units of percent.
 - h. Load output pulse mode in increments of 1second.
 - i. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.
 2. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
 - a. Device list report: All devices in a project listed by type.
 - b. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.

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- c. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
- d. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
- e. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
- f. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100%, 2 = all loads 75%, 3 = all loads 50%, 4 = all loads 25%, 5-16 = same as scene 1).
- g. Occupancy sensor report: Basic settings including time delay and sensitivity(ies) for all occupancy sensors.
3. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
 - a. Set, copy/paste an entire project site of sensor time delays.
 - b. Set, copy/paste an entire project site of sensor sensitivity settings.
 - c. Search based on room name and text labels.
 - d. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
 - e. Filter by parameter value to search for product with specific configurations.
4. Network-wide firmware upgrading remotely via the BACnet/IP network.
 - a. Mass firmware update of entire rooms.
 - b. Mass firmware update of specifically selected rooms or areas.
 - c. Mass firmware upgrade of specific products.

B. WattStopper Product Number: LMCS-100, LMCI-100

2.16 LMCP LIGHTING CONTROL PANELS

- A. Provide lighting control panels in the locations and capacities as indicated on the plans and schedules. Each panel shall be of modular construction and consist of the following components:
1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays.
 2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
 3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features:
 - a. Removable, plug-in terminal blocks with connections for all low voltage terminations.
 - b. Individual terminal block, override pushbutton, and LED status light for each relay.
 - c. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.
 - d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V

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analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.

- e. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
- f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
- g. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.
- h. Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.
- i. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
 - 1) Electrical:
 - a) 30 amp ballast at 277V
 - b) 20 amp ballast at 347V
 - c) 20amp tungsten at 120V
 - d) 30 amp resistive at 347V
 - e) 1.5 HP motor at 120V
 - f) 14,000 amp short circuit current rating (SCCR) at 347V
 - g) Relays shall be specifically UL 20 listed for control of plug-loads
 - 2) Mechanical:
 - a) Replaceable, 1/2" KO mounting with removable Class 2 wire harness.
 - b) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
 - c) Dual line and load terminals each support two #14 - #12 solid or stranded conductors.
 - d) Tested to 300,000 mechanical on/off cycles.
4. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
5. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
6. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall

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- be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.
7. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
 - a. Each panel shall include digital clock capability able to issue system wide automation commands to up to (11) eleven other panels for a total of (12) twelve networked lighting control panels. The clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
 - b. The clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
 - c. The clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for the clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
 - d. The clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
 - 1) Scheduled ON / OFF
 - 2) Manual ON / Scheduled OFF
 - 3) Astro ON / OFF (or Photo ON / OFF)
 - 4) Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
 - e. The user interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)
 - f. The clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
 - g. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.
 8. The lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.
 9. The lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet® protocol.
 - a. The panel shall have provision for an individual BACnet device ID and shall support the full 2²² range (0 – 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
 - b. The panel shall support MS/TP MAC addresses in the range of 0 – 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.
 - c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 – 64. The state of each relay shall be readable and writable by the BAS via the object present value property.

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- d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 – 64.
 - e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 – 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.
 - f. Setup and commissioning of the panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:
 - 1) Binary output objects in the instance range of 1 – 64 (one per relay) for on/off control of relays.
 - 2) Binary value objects in the instance range of 1 – 99 (one per channel) for normal hours/after hours schedule control.
 - 3) Binary input objects in the instance range of 1 – 64 (one per relay) for reading true on/off state of the relays.
 - 4) Analog value objects in the instance range of 101 – 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.
 - g. The description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.
 - h. The BO and BV 1 – 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (<http://www.bacnet.org/Addenda/Add-135-2010aa.pdf>)
 - i. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.
 - j. Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.
10. WattStopper Product Number: LMCP8, LMCP24 or LMCP48

2.17 USER INTERFACE

- A. Each lighting control panel system shall be supplied with at least (1) handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. The user interface shall have the following panel-specific functions as a minimum:

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1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.
5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
7. An additional handheld IR remote may optionally be specified to be permanently mounted to the panel interior via a retractable anti-theft lanyard to allow for convenient programming of the panel while assuring that the handheld programmer is always present at that panel. An unlimited number of handheld IR remotes may also be purchased for facilities staff as determined by the end user's representative.

B. WattStopper Product Number: LMCT-100

2.18 EMERGENCY LIGHTING CONTROL DEVICES

- A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
 2. Push to test button
 3. Auxiliary contact for remote test or fire alarm system interface

B. WattStopper Product Numbers: ELCU-100, ELCU-200.

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PART 3 EXECUTION

3.01 PRE-INSTALLATION MEETING

- A. A factory authorized manufacturer's representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:
 - 1. Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.
 - 2. Review the specifications for low voltage control wiring and termination.
 - 3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
 - 4. Discuss requirements for integration with other trades.

3.02 EXAMINATION

- A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 SENSOR INSTALLATION

- A. Comply with NECA 1.
- B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.04 CONTACTOR INSTALLATION

- A. Comply with NECA 1.
- B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.05 WIRING INSTALLATION

- A. Comply with NECA 1.

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- B. Wiring Method: Comply with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 3/4 inch (13 20 mm).
- C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.06 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 26 05 53 "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Lighting control devices will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.08 FACTORY SERVICES

- A. Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete fully functional system.

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- B. The electrical contractor shall provide both the manufacturer and the electrical engineer with three weeks written notice of the system start up and adjustment date.
- C. Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

3.09 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
 - 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.10 ACCEPTANCE TESTING SUPPORT SERVICES

- A. On all California projects, a certified lighting controls acceptance test technician (CLCATT) must verify the installation of the lighting control system. Manufacturer should include an extra day of factory technician's time to assist the CLCATT review the functionality and settings of the lighting control hardware per the requirements in the California State forms. It will be the CLCATT's responsibility to create and complete any forms required for the commissioning process, although the manufacturer or contractor may offer spreadsheets and/or printouts to assist the CLCATT with this task.

3.11 COMMISSIONING SUPPORT SERVICES

- A. On this project, a commissioning agent will be hired to verify the installation and programming of all building systems, which includes the lighting control system. Manufacturer should include an extra day of technician's time to review the functionality and settings of the lighting control hardware with the commissioning agent, including reviewing submittal drawings and ensuring that instructions on how to configure each device are readily available. Manufacturer is NOT responsible for helping the commissioning agent inspect the individual devices. It will be the commissioning agent's responsibility to create and complete any forms required for the commissioning process, although the manufacturer or contractor may offer spreadsheets and/or printouts to assist the agent with this task.
- B. The commissioning agent shall work with the electrical contractor during installation of the lighting control hardware to become familiar with the specific products. The agent may also accompany the manufacturer's technicians during their start-up work to better understand the process of testing, calibration and configuration of the products. However, the contractor and manufacturer shall ensure that interfacing with the agent does not prevent them from completing the requirements outlined in the contract documents.

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3.12 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within [two] <Insert number> years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.13 DEMONSTRATION

- A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 26 09 43.16 "Addressable-Luminaire Lighting Controls" and Section 26 09 43.23 "Relay-Based Lighting Controls."
- B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

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SECTION 26 12 19 - PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes pad-mounted, liquid-filled, medium-voltage distribution transformers, with primary and secondary bushings within or without air-terminal enclosures.

1.02 DEFINITIONS

- A. BIL: Basic Impulse Insulation Level.
- B. Bushing: An insulating structure including a central conductor, or providing a central passage for a conductor, with provision for mounting on a barrier, conducting or otherwise, for the purpose of insulating the conductor from the barrier and conducting current from one side of the barrier to the other.
- C. Bushing Elbow: An insulated device used to connect insulated conductors to separable insulated connectors on dead-front, pad-mounted transformers and to provide a fully insulated connection. This is also called an "elbow connector."
- D. Bushing Insert: That component of a separable insulated connector that is inserted into a bushing well to complete a dead-front, load break or nonload break, separable insulated connector (bushing).
- E. Bushing Well: A component of a separable insulated connector, either permanently welded or clamped to an enclosure wall or barrier, having a cavity that receives a replaceable component (bushing insert) to complete the separable insulated connector (bushing).
- F. Elbow Connector: See "bushing elbow" above.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For pad-mounted, liquid-filled, medium-voltage transformers.
 - 1. Include plans and elevations showing major components and features.
 - a. Include a plan view and cross section of equipment base, showing clearances, required workspace, and locations of penetrations for grounding and conduits.
 - 2. Include details of equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include single-line diagram.

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4. Include list of materials.
5. Include nameplate data.
6. Manufacturer's published time-current curves of the transformer high-voltage fuses, with transformer damage curve, inrush curve, and thru fault current indicated.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings:
 1. Provide 1/4" scale drawing demonstrating that installation has been coordinated with work of other trades. Use actual dimensions from approved equipment submittals to coordinate layout and installation of substation and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels. Include utilities site plan, drawn to scale, showing heavy equipment or truck access paths for maintenance and replacement.
- B. Qualification Data: For testing agency.
- C. Seismic Qualification Certificates: For transformer assembly, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity, and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Product Certificates: For transformers, signed by product manufacturer.
- E. Source quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For transformer and accessories to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- 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.

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- B. Comply with IEEE C2.
- C. Comply with IEEE C57.12.00.

2.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: The transformers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the transformer will remain in place without separation of any parts when subjected to the seismic forces specified and the transformer will be fully operational after the seismic event."
 - 2. Component Importance Factor: 1.5.
 - 3. Component Amplification Factor: 2.5.
 - 4. Component Response Modification Factor: 6.0.
- B. Windings Material: Copper.
- C. Surge Arresters: Comply with IEEE C62.11, Distribution Class; metal-oxide-varistor type, fully shielded, separable-elbow type, suitable for plugging into the inserts provided in the high-voltage section of the transformer. Connected in each phase of incoming circuit and ahead of any disconnecting device.
- D. Winding Connections: The connection of windings and terminal markings shall comply with IEEE C57.12.70.
- E. Efficiency: Comply with 10 CFR 431, Subpart K.
- F. Insulation: Transformer kVA rating shall be as follows: The average winding temperature rise above a 30 deg C ambient temperature shall not exceed 65 deg C and 80 deg C hottest-spot temperature rise at rated kVA when tested according to IEEE C57.12.90, using combination of connections and taps that give the highest average winding temperature rise.
- G. Tap Changer: External handle, for de-energized operation.
- H. Tank: Sealed, with welded-on cover. Designed to withstand internal pressure of not less than 7 psi (50 kPa) without permanent distortion and 15 psig (104 kPa) without rupture. Comply with IEEE C57.12.36.
- I. Enclosure Integrity: Comply with IEEE C57.12.28 for pad-mounted enclosures that contain energized electrical equipment in excess of 600 V that may be exposed to the public.
- J. Mounting: An integral skid mounting frame, suitable to allow skidding or rolling of transformer in any direction, and with provision for anchoring frame to pad.
- K. Insulating Liquids:
 - 1. Less-Flammable Liquids:

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- a. Edible-Seed-Oil-Based Dielectric: Listed and labeled by an NRTL as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic, having passed the Organisation for Economic Co-operation and Development G.L.203 with zero mortality, and shall be certified by the U.S. Environmental Protection Agency as biodegradable, meeting Environmental Technology Verification requirements.

L. Sound level shall comply with NEMA TR 1 requirements.

M. Corrosion Protection:

1. Fabricate front sill, hood, and tank base of single-compartment transformers from stainless steel according to ASTM A 167, Type 304 or 304L, not less than No. 13 U.S. gage, complying with requirements of IEEE C57.12.28, standard color green.
2. Base and Cabinets of Two Compartment Transformers: Fabricate from stainless steel according to ASTM A 167, Type 304 or 304L, not less than No. 13 U.S. gage. Coat transformer with manufacturer's standard green color coating complying with requirements of IEEE C57.12.28, in manufacturer's standard color green.

2.03 THREE-PHASE TRANSFORMERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB.
2. Cooper Industries, Inc.
3. Eaton.
4. ERMCO-ECI.
5. General Electric Company.

B. Description:

1. 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.
2. Comply with IEEE C57.12.26.

C. Compartment Construction:

1. Double-Compartment Construction: Individual compartments for high- and low-voltage sections, formed by steel isolating barriers that extend full height and depth of compartments, with hinged, lift-off doors and three-point latching, with a stop in the open position and provision for padlocking.

D. Primary Fusing: Designed and rated to provide thermal protection of transformer by sensing overcurrent and high liquid temperature.

1. 150-kV BIL current-limiting fuses, conforming to requirements of IEEE C37.47.
2. Interrupting Rating: 50,000 rms A symmetrical at system voltage.
3. Fuse Assembly: Bayonet-type, liquid-immersed, expulsion fuses in series with liquid-immersed, partial-range, current-limiting fuses. Bayonet fuse shall sense both high

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- currents and high oil temperature to provide thermal protection to the transformer. Connect current-limiting fuses ahead of radial-feed load-break switch.
4. Provide bayonet fuse assembly with an oil retention valve and an external drip shield inside the housing to eliminate or minimize oil spills. Valve shall close when fuse holder is removed and an external drip shield is installed.
 5. Provide a conspicuously displayed warning adjacent to bayonet fuse(s), cautioning against removing or inserting fuses unless transformer has been de-energized and tank pressure has been released.
- E. High-Voltage Section: Dead-front design.
1. To connect primary cable, use separable insulated connectors; coordinated with and complying with requirements of Section 260513 "Medium-Voltage Cables." Bushings shall be one-piece units, with ampere and BIL ratings the same as connectors.
 2. Bushing inserts:
 - a. Conform to the requirements of IEEE 386.
 - b. Rated at 200 A, with voltage class matching connectors. Provide a parking stand near each bushing well
 - c. Provide insulated protective caps for insulating and sealing out moisture from unused bushing inserts and insulated standoff bushings.
 3. Bushing wells configured for loop-feed application.
 4. Access to liquid-immersed fuses.
 5. Dead-front surge arresters.
 6. Tap-changer operator.
 7. Load-Break Switch:
 - a. Radial-feed, liquid-immersed type with voltage class and BIL matching that of separable connectors, with a continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 12 kA rms symmetrical.
 - b. Loop-feed sectionalizing switches, using three two-position, liquid-immersed-type switches for closed transition loop-feed and sectionalizing operation. Voltage class and BIL shall match that of separable connectors, with a continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 12 kA rms symmetrical. Switch operation shall be as follows:
 - 1) Position I: Line A connected to line B and both lines connected to the transformer.
 - 2) Position II: Transformer connected to line A only.
 - 3) Position III: Transformer connected to line B only.
 - 4) Position IV: Transformer disconnected and line A not connected to line B.
 - 5) Position V: Transformer disconnected and line A connected to line B.
 8. Ground pad.
- F. Low-Voltage Section:
1. Bushings with spade terminals drilled for terminating the number of conductors indicated on the Drawings, and the lugs that comply with requirements of Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- G. Transformer Accessories:
1. Drain and filter connection.
 2. Filling and top filter press connections.

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3. Pressure-vacuum gauge.
4. Dial-type analog thermometer with alarm contacts.
5. Magnetic liquid level indicator with high and low alarm contacts.
6. Automatically resetting pressure-relief device. Device flow shall be as recommended by manufacturer.
7. Stainless-steel ground connection pads.
8. Machine-engraved nameplate, made of anodized aluminum or stainless steel.
9. Sudden pressure relay for remote alarm or trip when internal transformer pressure rises at field-set rate. Provide with seal-in delay.

2.04 SERVICE CONDITIONS

- A. Transformers shall be suitable for operation under service conditions specified as usual service conditions in IEEE C57.12.00, except for the following:
 1. Altitudes above 3300 feet (1000 m).
 2. Cooling air temperature exceeds limits.
 3. Excessive load current harmonic factor.
 4. Operation above rated voltage or below rated frequency.
 5. Exposure to explosive environments.
 6. Exposure to fumes, vapors, or dust.
 7. Exposure to hot and humid climate or to excessive moisture, including steam, salt spray, and dripping water.
 8. Exposure to seismic shock or to abnormal vibration, shock, or tilting.
 9. Exposure to excessively high or low temperatures.
 10. Unusual transportation or storage conditions.
 11. Unusual grounding resistance conditions.

2.05 CONTROL NETWORK

- A. Controllers: Support serial MS/TP and Ethernet IP communications, and able to communicate directly via RS-485 serial networks and Ethernet 10Base-T networks as a native device.

2.06 WARNING LABELS AND SIGNS

- A. Comply with requirements for labels and signs specified in Section 260553 "Identification for Electrical Systems."
 1. High-Voltage Warning Label: Provide self-adhesive warning signs on outside of high-voltage compartment door(s). Sign legend shall be "DANGER HIGH VOLTAGE" printed in two lines of nominal 2-inch- ((50-mm)-)high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background.
 2. Arc Flash Warning Label: Provide self-adhesive warning signs on outside of high-voltage compartment door(s), warning of potential electrical arc flash hazards and appropriate personal protective equipment required.

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2.07 SOURCE QUALITY CONTROL

- A. Provide manufacturer's certificate that the transformer design tests comply with IEEE C57.12.90.
1. Perform the following factory-certified routine tests on each transformer for this Project:
 - a. Resistance.
 - b. Turns ratio, polarity, and phase relation.
 - c. Transformer no-load losses and excitation current at 100 percent of ratings.
 - d. Transformer impedance voltage and load loss.
 - e. Operation of all devices.
 - f. Lightning impulse.
 - g. Low frequency.
 - h. Leak.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine pad-mounted, liquid-filled, medium-voltage transformers upon delivery.
1. Upon delivery of transformers and prior to unloading, inspect equipment for any damage that may have occurred during shipment or storage.
 2. Verify that tie rods and chains are undamaged and tight, and that all blocking and bracing is tight. Verify that there is no evidence of load shifting in transit, and that readings from transportation shock recorders, if equipped, are within manufacturer's recommendations.
 3. Verify that there is no indication of external damage and no dents or scratches in doors and sill, tank walls, radiators and fins, or termination provisions.
 4. Verify that there is no evidence of insulating-liquid leakage on transformer surfaces, at weld seams, on high- or low-voltage bushing parts, and at transformer base.
 5. Verify that there is positive pressure or vacuum on tank. Check pressure gauge; it is required to read other than zero.
 6. Compare transformers and accessories received with bill of materials to verify that shipment is complete. Verify that transformers and accessories conform with manufacturer's quotation and shop drawings. If shipment is incomplete or does not comply with Project requirements, notify manufacturer in writing immediately.
 7. Verify presence of polychlorinated biphenyl content labeling.
 8. Unload transformers carefully, observing all packing label warnings and handling instructions.
 9. Open termination compartment doors and inspect components for damage or displaced parts, loose or broken connections, cracked or chipped insulators, bent mounting flanges, dirt or foreign material, and water or moisture.
- B. Handling:
1. Handle transformers carefully, in accordance with manufacturer recommendations, to avoid damage to enclosure, termination compartments, base, frame, tank, and internal components. Do not subject transformers to impact, jolting, jarring, or rough handling.
 2. Protect transformer termination compartments against entrance of dust, rain, and snow.
 3. Transport transformers upright, to avoid internal stresses on core and coil mounting assembly and to prevent trapping air in windings. Do not tilt or tip transformers.

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4. Verify that transformer weights are within rated capacity of handling equipment.
5. Use only manufacturer-recommended points for lifting, jacking, and pulling. Use all lifting lugs when lifting transformers.
6. Use jacks only at corners of tank base plate.
7. Use nylon straps of same length to balance and distribute weight when handling transformers with a crane.
8. Use spreaders or a lifting beam to obtain a vertical lift and to protect transformer from straps bearing against enclosure. Lifting cable pull angles may not be greater than 15 degrees from vertical.
9. Exercise care not to damage tank base structure when handling transformer using skids or rollers. Use skids to distribute stresses over tank base when using rollers under large transformers.

C. Storage:

1. Store transformers in accordance with manufacturer's recommendations.
2. Transformers may be stored outdoors. If possible, store transformers at final installation locations on concrete pads. If dry concrete surfaces are unavailable, use pallets of adequate strength to protect transformers from direct contact with ground. Ensure transformer is level.
3. Ensure that transformer storage location is clean and protected from severe conditions. Protect transformers from dirt, water, contamination, and physical damage. Do not store transformers in presence of corrosive or explosive gases. Protect transformers from weather when stored for more than three months.
4. Store transformers with compartment doors closed.
5. Regularly inspect transformers while in storage and maintain documentation of storage conditions, noting any discrepancies or adverse conditions. Verify that an effective pressure seal is maintained using pressure gauges. Visually check for insulating-liquid leaks and rust spots.

D. Examine areas and space conditions for compliance with requirements for pad-mounted, liquid-filled, medium-voltage transformers and other conditions affecting performance of the Work.

E. Examine roughing-in of conduits and grounding systems to verify the following:

1. Wiring entries comply with layout requirements.
2. Entries are within conduit-entry tolerances specified by manufacturer, and no feeders will cross section barriers to reach load or line lugs.

F. Examine concrete bases for suitable conditions for transformer installation.

G. Pre-Installation Checks:

1. Verify removal of any shipping bracing after placement.
2. Remove a sample of insulating liquid according to ASTM D 923. Insulating-liquid values shall comply with NETA ATS, Table 100.4. Sample shall be tested for the following:
 - a. Dielectric Breakdown Voltage: ASTM D 877 or ASTM D 1816.
 - b. Acid Neutralization Number: ASTM D 974.
 - c. Specific Gravity: ASTM D 1298.
 - d. Interfacial Tension: ASTM D 971.
 - e. Color: ASTM D 1500.

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- f. Visual Condition: ASTM D 1524.
- g. Water in Insulating Liquids: Comply with ASTM D 1533.
- h. Power Factor or Dissipation Factor: ASTM D 924.

H. Verify that ground connections are in place and that requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at transformer location.

I. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install transformers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
- B. Transformer shall be installed level and plumb and shall tilt less than 1.5 degrees while energized.
- C. Comply with requirements for vibration isolation and seismic control devices specified in Section 260529 "Hangers and Supports for Electrical Systems" and Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and IEEE C2.

3.03 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. For counterpoise, use tinned bare copper cable not smaller than No. 4/0 AWG, buried not less than 30 inches (765 mm) below grade interconnecting the grounding electrodes. Bond surge arrester and neutrals directly to transformer enclosure and then to grounding electrode system with bare copper conductors, sized as shown. Keep lead lengths as short as practicable, with no kinks or sharp bends.
 - 2. Fence and equipment connections shall not be smaller than No. 4 AWG. Ground fence at each gate post and corner post and at intervals not exceeding 10 ft. (3050 mm). Bond each gate section to fence post using 1/8 by 1 inch (3 by 25 mm) tinned flexible braided copper strap and clamps.
 - 3. Make joints in grounding conductors and loops by exothermic weld or compression connector.
 - 4. Terminate all grounding and bonding conductors on a common equipment grounding terminal on transformer enclosure.
 - 5. Complete transformer tank grounding and lightning arrester connections prior to making any other electrical connections.
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

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1. Maintain air clearances between energized live parts and between live parts and ground for exposed connections in accordance with manufacturer recommendations.
 2. Bundle associated phase, neutral, and equipment grounding conductors together within transformer enclosure. Arrange conductors such that there is not excessive strain that could cause loose connections. Allow adequate slack for expansion and contraction of conductors.
- C. Terminate medium-voltage cables in incoming section of transformers according to Section 260513 "Medium-Voltage Cables."

3.04 SIGNS AND LABELS

- A. Comply with installation requirements for labels and signs specified in Section 260553 "Identification for Electrical Systems."
- B. Install warning signs as required to comply with 29 CFR 1910.269.

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
1. General Field-Testing Requirements:
 - a. Comply with provisions of NFPA 70B Ch. "Testing and Test Methods."
 - b. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
 - c. After installing transformer but before primary is energized, verify that grounding system at the transformer is tested at specified value or less.
 - d. After installing transformer and after electrical circuitry has been energized, test for compliance with requirements.
 - e. Visual and Mechanical Inspection:
 - 1) Verify equipment nameplate data complies with Contract Documents.
 - 2) Inspect bolted electrical connections for high resistance using one of the following two methods:
 - a) Use a low-resistance ohmmeter to compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - b) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In absence of manufacturer's published data, use NETA ATS, Table 100.12.
 - f. Remove and replace malfunctioning units and retest.
 - g. Prepare test and inspection reports. Record as-left set points of all adjustable devices.

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2. Medium-Voltage Surge Arrester Field Tests:
 - a. Visual and Mechanical Inspection:
 - 1) Inspect physical and mechanical condition.
 - 2) Verify arresters are clean.
 - 3) Verify that ground lead on each device is individually attached to a ground bus or ground electrode.
 - b. Electrical Test:
 - 1) Perform an insulation-resistance test on each arrester, phase terminal-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Replace units that fail to comply with recommended minimum insulation resistance listed in that table.
 - 2) Perform a watts-loss test. Evaluate watts-loss values by comparison with similar units and test equipment manufacturer's published data.
3. Liquid-Filled Transformer Field Tests:
 - a. Visual and Mechanical Inspection:
 - 1) Test dew point of tank gases if applicable.
 - 2) Inspect anchorage, alignment, and grounding.
 - 3) Verify bushings are clean.
 - 4) Verify that alarm, control, and trip settings on temperature and level indicators are set and operate within manufacturer's recommended settings.
 - 5) Verify that liquid level in tanks is within manufacturer's published tolerances.
 - 6) Perform specific inspections and mechanical tests recommended by manufacturer.
 - 7) Verify presence of transformer surge arresters and that their ratings are as specified.
 - 8) Verify that as-left tap connections are as specified.
 - b. Electrical Tests:
 - 1) Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index; the value of the index shall not be less than 1.0.
 - 2) Perform power-factor or dissipation-factor tests on all windings according to test equipment manufacturer's published data. Maximum winding insulation power-factor/dissipation-factor values shall be according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.3.
 - 3) Measure core insulation resistance at 500-V dc if the core is insulated and the core ground strap is removable. Core insulation-resistance values shall not be less than 1 megohm at 500-V dc.
 - 4) Perform turns-ratio tests at tap positions. Turns-ratio test results shall not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.
 - 5) Perform an excitation-current test on each phase. The typical excitation-current test data pattern for a three-legged core transformer is two similar current readings and one lower current reading. Investigate and correct if test shows a different pattern.

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- 6) Measure resistance of each winding at each tap connection, and record temperature-corrected winding-resistance values in the Operations and Maintenance Manual.
- 7) Perform an applied-voltage test on high- and low-voltage windings-to-ground. Comply with IEEE C57.12.91, Sections 10.2 and 10.9. This test is not required for single-phase transformers and for three-phase Y-Y-connected transformers.
- 8) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- 9) Remove a sample of insulating liquid according to ASTM D 923, and perform dissolved-gas analysis according to IEEE C57.104 or ASTM D 3612.

3.06 FOLLOW-UP SERVICE

- A. Voltage Monitoring and Adjusting: After Substantial Completion, if requested by Owner, but not more than six months after Final Acceptance, perform the following voltage monitoring:
 1. During a period of normal load cycles as evaluated by Owner, perform seven days of three-phase voltage recording at the outgoing section of each transformer. Use voltmeters with calibration traceable to the National Institute of Science and Technology standards and with a chart speed of not less than 1 inch (25 mm) per hour. Voltage unbalance greater than 1 percent between phases, or deviation of any phase voltage from the nominal value by more than plus or minus 5 percent during test period, is unacceptable.
 2. Corrective Action: If test results are unacceptable, perform the following corrective action, as appropriate:
 - a. Adjust transformer taps.
 - b. Prepare written request for voltage adjustment by electric utility.
 3. Retests: Repeat monitoring, after corrective action is performed, until satisfactory results are obtained.
 4. Report:
 - a. Prepare a written report covering monitoring performed and corrective action taken.
- B. Infrared Inspection: Perform survey during periods of maximum possible loading. Remove all necessary covers prior to inspection.
 1. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of transformer's electrical power connections.
 2. Instrument: Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1°C at 30°C.
 3. Record of Infrared Inspection: Prepare a certified report that identifies testing technician and equipment used, and lists results as follows:
 - a. Description of equipment to be tested.
 - b. Discrepancies.
 - c. Temperature difference between area of concern and reference area.
 - d. Probable cause of temperature difference.
 - e. Areas inspected. Identify inaccessible and unobservable areas and equipment.
 - f. Identify load conditions at time of inspection.

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- g. Provide photographs and thermograms of deficient area.
4. Act on inspection results according to recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.

3.07 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.

END OF SECTION

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SECTION 26 24 13 - SWITCHBOARDS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Service and distribution switchboards rated 600 V and less.
 - 2. Surge protection devices.
 - 3. Disconnecting and overcurrent protective devices.
 - 4. Instrumentation.
 - 5. Control power.
 - 6. Accessory components and features.
 - 7. Identification.
- B. Related Requirements
 - 1. Section 260573.13 "Short-Circuit Studies" for fault-current and protective device short-circuit studies.
 - 2. Section 260573.16 "Coordination Studies" for fault-current and protective device coordination studies.
 - 3. Section 260573.19 "Arc-Flash Hazard Analysis" for arc-flash analysis and arc-flash label requirements.

1.02 ACTION SUBMITTALS

- A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.
 - 1. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
- B. Shop Drawings: For each switchboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
 - 5. Detail utility company's metering provisions with indication of approval by utility company.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
 - 8. Include schematic and wiring diagrams for power, signal, and control wiring.
- C. Delegated Design Submittal:
 - 1. For arc-flash hazard analysis.
 - 2. For arc-flash labels.

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1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Seismic Qualification Data: Certificates, for switchboards, overcurrent protective devices, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Routine maintenance requirements for switchboards and all installed components.
 - b. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - c. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.

1.05 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. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type but no fewer than two of each size and type.
 - 2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 - 3. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
 - 4. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
 - 5. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
 - 6. Indicating Lights: Equal to 10 percent of quantity installed for each size and type but no less than one of each size and type.

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1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.
- B. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.
- B. Remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation.
- C. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.08 FIELD CONDITIONS

- A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.
- B. Environmental Limitations:
 - 1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).
- C. Unusual Service Conditions: NEMA PB 2, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet (2000 m).
- D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without Owner's written permission.
 - 4. Comply with NFPA 70E.

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1.09 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- C. Provide 1/4" scale drawing demonstrating that installation has been coordinated with work of other trades. Use actual dimensions from approved equipment submittals to coordinate layout and installation of panelboard, switchgear, transformers and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Three years from date of Substantial Completion.
- B. Manufacturer's Warranty: Manufacturer's agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.
 2. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.02 SWITCHBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton.

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2. General Electric Company.
 3. SIEMENS Industry, Inc.; Energy Management Division.
 4. Square D; by Schneider Electric.
- B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. 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.
- E. Comply with NEMA PB 2.
- F. Comply with NFPA 70.
- G. Comply with UL 891.
- H. Front-Connected, Front-Accessible Switchboards:
1. Main Devices: Panel mounted.
 2. Branch Devices: Panel mounted.
 3. Sections front and rear aligned.
- I. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
- J. Indoor Enclosures: Steel, NEMA 250, Type 1.
- K. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- L. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.
- M. Customer Metering Compartment: A separate customer metering and section with front hinged door, for indicated metering, and current transformers for each meter. Current transformer secondary wiring shall be terminated on shorting-type terminal blocks. Include potential

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transformers having primary and secondary fuses with disconnecting means and secondary wiring terminated on terminal blocks.

- N. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
- O. Removable, Hinged Rear Doors and Compartment Covers: Secured by captive thumb screws, for access to rear interior of switchboard.
- P. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
- Q. Buses and Connections: Three phase, four wire unless otherwise indicated.
 - 1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
 - 2. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated.
 - 3. Copper feeder circuit-breaker line connections.
 - 4. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
 - 5. Ground Bus: 1/4-by-2-inch- (6-by-50-mm-) hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit ground conductors.
 - 6. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
 - 7. Disconnect Links:
 - a. Isolate neutral bus from incoming neutral conductors.
 - b. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.
 - 8. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
- R. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.
- S. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

2.03 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

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3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long and short time adjustments.
 - d. Ground-fault pickup level, time delay, and I squared t response.
 4. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - c. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 - d. Communication Capability: Circuit-breaker-mounted Integral communication module with functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."
 - e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 - f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - g. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
- B. Bolted-Pressure Contact Switch: Operating mechanism uses rotary-mechanical-bolting action to produce and maintain high clamping pressure on the switch blade after it engages the stationary contacts.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton.
 - b. SIEMENS Industry, Inc.; Energy Management Division.
 - c. Square D.
 2. Main-Contact Interrupting Capability: Minimum of 12 times the switch current rating.
 3. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.
 - a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
 4. Auxiliary Switches: Factory installed, SPDT, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
 5. Service-Rated Switches: Labeled for use as service equipment.
 6. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.
 - a. Configuration: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

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- b. Internal Memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.
 - c. No-Trip Relay Test: Permits ground-fault simulation test without tripping switch.
 - d. Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).
- 7. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- D. Fuses are specified in Section 262813 "Fuses."

2.04 INSTRUMENTATION

- A. Instrument Transformers: NEMA EI 21.1, and the following:
 - 1. Potential Transformers: NEMA EI 21.1; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
 - 2. Current Transformers: NEMA EI 21.1; 5 A, 60 Hz, secondary; wound type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
 - 3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
 - 4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.
- B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
 - 1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
 - a. Phase Currents, Each Phase: Plus or minus 0.5 percent.
 - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
 - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
 - d. Megawatts: Plus or minus 1 percent.
 - e. Megavars: Plus or minus 1 percent.
 - f. Power Factor: Plus or minus 1 percent.
 - g. Frequency: Plus or minus 0.1 percent.
 - h. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.
 - i. Megawatt Demand: Plus or minus 1 percent; demand interval programmable from five to 60 minutes.
 - j. Contact devices to operate remote impulse-totalizing demand meter.
 - 2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

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2.05 CONTROL POWER

- A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

2.06 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.
- C. Mounting Accessories: For anchors, mounting channels, bolts, washers, and other mounting accessories, comply with requirements in Section 260548.16 "Seismic Controls for Electrical Systems" or manufacturer's instructions.

2.07 IDENTIFICATION

- A. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components, complete with lettered designations.
- B. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.
 - 1. Lift or move panelboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's instructions.
 - 2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.
 - 3. Protect from moisture, dust, dirt, and debris during storage and installation.
 - 4. Install temporary heating during storage per manufacturer's instructions.
- B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.
- C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work or that affect the performance of the equipment.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.02 INSTALLATION

- A. Install switchboards and accessories according to NEMA PB 2.1.
- B. Equipment Mounting: Install switchboards on concrete base, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches (50-mm) above concrete base after switchboard is anchored in place.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to switchboards.
 - 6. Anchor switchboard to building structure at the top of the switchboard if required or recommended by the manufacturer.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.
- D. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- E. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
- F. Install filler plates in unused spaces of panel-mounted sections.
- G. Install overcurrent protective devices, surge protection devices, and instrumentation.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- H. Install spare-fuse cabinet.
- I. Comply with NECA 1.

3.03 CONNECTIONS

- A. Comply with requirements for terminating cable trays specified in Section 260536 "Cable Trays for Electrical Systems." Drawings indicate general arrangement of cable trays, fittings, and specialties.

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- B. Bond conduits entering underneath the switchboard to the equipment ground bus with a bonding conductor sized per NFPA 70.
- C. Support and secure conductors within the switchboard according to NFPA 70.
- D. Extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

3.04 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
- C. Tests and Inspections:
 - 1. Acceptance Testing:
 - a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the switchboard, and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
 - b. Test continuity of each circuit.
 - 2. Test ground-fault protection of equipment for service equipment per NFPA 70.
 - 3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 4. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 5. Perform the following infrared scan tests and inspections, and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:

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- 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 6. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
 - D. Switchboard will be considered defective if it does not pass tests and inspections.
 - E. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- 3.06 ADJUSTING**
- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
 - B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573.16 "Coordination Studies."
- 3.07 PROTECTION**
- A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.
- 3.08 DEMONSTRATION**
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION

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SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.
 - 3. Electronic-grade panelboards.

1.02 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
 - 1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
 - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details.
 - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
 - 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
 - 4. Detail bus configuration, current, and voltage ratings.
 - 5. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 6. Include evidence of NRTL listing for SPD as installed in panelboard.
 - 7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 8. Include wiring diagrams for power, signal, and control wiring.

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9. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

- C. Delegated Design Submittal:
 1. For arc-flash hazard study.
 2. For arc-flash labels.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- A. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing..
- B. Provide 1/4" scale drawing demonstrating that installation has been coordinated with work of other trades. Use actual dimensions from approved equipment submittals to coordinate layout and installation of transformers and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.06 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. Keys: Two spares for each type of panelboard cabinet lock.
 2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.
 3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

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1.08 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

1.09 FIELD CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet (2000 m).
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electric service.
 - 2. Do not proceed with interruption of electric service without Owner's written permission.
 - 3. Comply with NFPA 70E.

1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
 - 1. Panelboard Warranty Period: 18 months from date of Substantial Completion.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.
 - 1. SPD Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PANELBOARDS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

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- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- 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 NEMA PB 1.
- E. Comply with NFPA 70.
- F. Enclosures: Flush and Surface-mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Greenhouse: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - 2. Height: 90 inches (2286 mm) to top of trim maximum.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
 - 4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 - 5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 6. Finishes:
 - a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Same finish as panels and trim.
 - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
- G. Incoming Mains:
 - 1. Location: Convertible between top and bottom.
 - 2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.
- H. Phase, Neutral, and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - a. Plating shall run entire length of bus.
 - b. Bus shall be fully rated the entire length.
 - 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
 - 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

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5. Full-Size Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
 6. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and listed and labeled by an NRTL acceptable to authority having jurisdiction, as suitable for nonlinear loads in electronic-grade panelboards and others designated on Drawings. Connectors shall be sized for double-sized or parallel conductors as indicated on Drawings. Do not mount neutral bus in gutter.
 7. Split Bus: Vertical buses divided into individual vertical sections.
- I. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Terminations shall allow use of 75 deg C rated conductors without derating.
 3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
 4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
 5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
 6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 8. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.
 9. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- J. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- K. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings calculated in Section 260573.13 Short-Circuit Study, but not less than 10,000 A rms symmetrical.
 2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings calculated in Section 260573.13 Short-Circuit Study, but not less than 14,000 A rms symmetrical.

2.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

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1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2.03 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton.
 2. General Electric Company; GE Energy Management - Electrical Distribution.
 3. SIEMENS Industry, Inc.; Energy Management Division.
 4. Square D; by Schneider Electric.
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
- D. Mains: Circuit breaker.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton.
 2. General Electric Company; GE Energy Management - Electrical Distribution.
 3. SIEMENS Industry, Inc.; Energy Management Division.
 4. Square D; by Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only as indicated on schedule.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door

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shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.05 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
 2. General Electric Company; GE Energy Management - Electrical Distribution.
 3. SIEMENS Industry, Inc.; Energy Management Division.
 4. Square D; by Schneider Electric.
- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents calculated in Section 260573.13 Short-Circuit Study.
1. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic Trip Circuit Breakers:
 - a. RMS sensing.
 - b. Field-replaceable rating plug or electronic trip.
 - c. Digital display of settings, trip targets, and indicated metering displays.
 - d. Multi-button keypad to access programmable functions and monitored data.
 - e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
 - f. Integral test jack for connection to portable test set or laptop computer.
 - g. Field-Adjustable Settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long and short time adjustments.
 - 4) Ground-fault pickup level, time delay, and I squared T response.
 4. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
 5. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
 6. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 7. Subfeed Circuit Breakers: Vertically mounted.
 8. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.
 - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.

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- f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
- g. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."
- h. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
- i. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
- j. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
- k. Auxiliary Contacts: Two, SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
- l. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
- m. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
- n. Multipole units enclosed in a single housing with a single handle.
- o. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
- p. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.06 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.
 - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.07 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NECA 407.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NECA 407.
- D. Equipment Mounting:
 - 1. Attach panelboard to the vertical finished or structural surface behind the panelboard.
 - 2. Comply with requirements for seismic control devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- F. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- G. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- H. Mount panelboard cabinet plumb and rigid without distortion of box.
- I. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

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- J. Mount surface-mounted panelboards to steel slotted supports 5/8 inch (16 mm) in depth. Orient steel slotted supports vertically.
- K. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
 - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- L. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- M. Install filler plates in unused spaces.
- N. Stub four 1-inch (25 mm) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (25 mm) empty conduits into raised floor space or below slab not on grade.
- O. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- P. Mount spare fuse cabinet in accessible location.

3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.04 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.

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B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Do not perform optional tests. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573.16 "Coordination Studies."

3.06 PROTECTION

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

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SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
1. Straight-blade convenience, hospital-grade, isolated-ground, and tamper-resistant receptacles.
 2. GFCI receptacles.
 3. Twist-locking receptacles.
 4. Cord and plug sets.
 5. Toggle switches.
 6. Wall plates.
 7. Floor service outlets.

1.03 DEFINITIONS

- A. Abbreviations of Manufacturers' Names:
1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
 2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
 3. Leviton: Leviton Mfg. Company, Inc.
 4. Pass & Seymour: Pass& Seymour/Legrand.
- B. BAS: Building automation system.
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- F. RFI: Radio-frequency interference.
- G. SPD: Surge protective device.
- H. UTP: Unshielded twisted pair.

1.04 ACTION SUBMITTALS

- A. Samples: One for each type of device and wall plate specified, in each color specified.

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1.05 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 PRODUCTS

2.01 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.
- D. Devices for Owner-Furnished Equipment:
 - 1. Receptacles: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.
- E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 STRAIGHT-BLADE RECEPTACLES

- A. Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).

2.03 GFCI RECEPTACLES

- A. General Description:
 - 1. 125 V, 20 A, straight blade, non-feed-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.

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3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
 - e. <Insert manufacturer's name>.

2.04 TWIST-LOCKING RECEPTACLES

- A. Twist-Lock, Single Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
 - e. <Insert manufacturer's name>.

2.05 CORD AND PLUG SETS

- A. Description:
 1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
 3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for **connection**.

2.06 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:
 1. Single Pole:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- 1) Eaton (Arrow Hart).
- 2) Hubbell Incorporated; Wiring Device-Kellems.
- 3) Leviton Manufacturing Co., Inc.
- 4) Pass & Seymour/Legrand (Pass & Seymour).

2. Two Pole:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Eaton (Arrow Hart).
- 2) Hubbell Incorporated; Wiring Device-Kellems.
- 3) Leviton Manufacturing Co., Inc.
- 4) Pass & Seymour/Legrand (Pass & Seymour).

2.07 DECORATOR-STYLE DEVICES, 20 A

- A. Decorator Duplex Receptacles, 125 V, 20 A
1. Description: Two pole, three wire, and self-grounding. Square face.
 2. Configuration: NEMA WD 6, Configuration 5-20R.
 3. Standards: Comply with UL 498.
- B. Decorator Single-Pole Switches, 120/277 V, 20 A
1. Comply with UL 20.

2.08 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
 3. Material for Greenhouse: 0.035-inch- (1-mm-) thick, satin-finished, Type 302 stainless steel.
 4. Material for Unfinished Spaces: Galvanized steel.
 5. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.09 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Round, die-cast aluminum with satin finish.
- D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

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- E. Data Communication Outlet: Blank cover with bushed cable opening

2.10 FINISHES

- A. Device Color:
1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
 2. Wiring Devices Connected to Emergency Power System: Red.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtail existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.

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5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.03 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.04 FIELD QUALITY CONTROL

- A. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Perform the following tests and inspections:
1. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.

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4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- D. Wiring device will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

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SECTION 26 28 13 - FUSES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600 V ac and less for use in the following:
 - a. Control circuits.
 - b. Enclosed controllers.
 - c. Enclosed switches.
 - 2. Spare-fuse cabinets.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 3. Current-limitation curves for fuses with current-limiting characteristics.
 - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in electronic format suitable for use in coordination software and in PDF format.
 - 5. Coordination charts and tables and related data.
 - 6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017700 "Closeout Procedures," include the following:
 - 1. Ambient temperature adjustment information.
 - 2. Current-limitation curves for fuses with current-limiting characteristics.
 - 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit in electronic format suitable for use in coordination software and in PDF format.
 - 4. Coordination charts and tables and related data.

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1.04 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.05 FIELD CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Bussmann, an Eaton business.
 - 2. Edison; a brand of Bussmann by Eaton.
 - 3. Littelfuse, Inc.
 - 4. Mersen USA.
- B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.02 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
 - 1. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
 - 2. Type RK-5: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
 - 3. Type J: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
- B. 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.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

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2.03 SPARE-FUSE CABINET

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 - 2. Finish: Gray, baked enamel.
 - 3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
 - 4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. Motor Branch Circuits: Class RK1 Class RK5, time delay.
 - 2. Other Branch Circuits: Class RK1, time delay Class RK5, time delay.

3.03 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s) in location shown on the Drawings or as indicated in the field by Architect.

3.04 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

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SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 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.

1.02 SUMMARY

- A. Section Includes:
 1. Fusible switches.
 2. Nonfusible switches.
 3. Molded-case circuit breakers (MCCBs).
 4. Molded-case switches.
 5. Enclosures.

1.03 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.06 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 2. Fuse Pullers: Two for each size and type.

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1.07 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.08 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
 - 2. Altitude: Not exceeding 6600 feet (2010 m).

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.02 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

2.03 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB Inc.
 - 2. Eaton.
 - 3. General Electric Company.

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4. SIEMENS Industry, Inc.; Energy Management Division.
5. Square D; by Schneider Electric.

B. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 600-V ac.
4. 1200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses.
6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 240-V ac.
2. Hookstick Handle: Allows use of a hookstick to operate the handle.
3. Lugs: Mechanical type, suitable for number, size, and conductor material.
4. Service-Rated Switches: Labeled for use as service equipment.

2.04 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company.
3. SIEMENS Industry, Inc.; Energy Management Division.
4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Three Pole, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 240-V ac.
2. Hookstick Handle: Allows use of a hookstick to operate the handle.
3. Lugs: Mechanical type, suitable for number, size, and conductor material.
4. Service-Rated Switches: Labeled for use as service equipment.

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2.05 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
 2. General Electric Company.
 3. SIEMENS Industry, Inc.; Energy Management Division.
 4. Square D; by Schneider Electric.
- B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated Series rating is not allowed.
- E. MCCBs shall be equipped with a device for locking in the isolated position.
- F. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- G. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- H. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- I. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
1. Instantaneous trip.
 2. Long- and short-time pickup levels.
 3. Long- and short-time time adjustments.
 4. Ground-fault pickup level, time delay, and I-squared t response.
- J. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

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- K. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- L. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 6. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 7. Alarm Switch: One NC contact that operates only when circuit breaker has tripped.
 8. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 9. Electrical Operator: Provide remote control for on, off, and reset operations.
 10. Accessory Control Power Voltage: Integrally mounted, self-powered; 240-V ac.

2.06 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, 12) [copper-free cast aluminum alloy (NEMA 250 Types 7, 9)].
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
- E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

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- F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.02 PREPARATION

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electric service.
 2. Indicate method of providing temporary electric service.
 3. Do not proceed with interruption of electric service without Owner's written permission.
 4. Comply with NFPA 70E.

3.03 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 2. Outdoor Locations: NEMA 250, Type 3R
 3. Greenhouse: NEMA 250, Type 4X, stainless steel.
 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

3.04 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

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- D. Install fuses in fusible devices.
- E. Comply with NFPA 70 and NECA 1.

3.05 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.06 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections
- C. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.
 - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
 - i. Verify correct phase barrier installation.
 - j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
 - 2. Electrical Tests:
 - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

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- b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
- d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
- e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

D. Tests and Inspections for Molded Case Circuit Breakers:

- 1. Visual and Mechanical Inspection:
 - a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, grounding, and clearances.
 - d. Verify that the unit is clean.
 - e. Operate the circuit breaker to ensure smooth operation.
 - f. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - g. Inspect operating mechanism, contacts, and chutes in unsealed units.
 - h. Perform adjustments for final protective device settings in accordance with the coordination study.
- 2. Electrical Tests:
 - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate

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- values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
- c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
 - e. Determine the following by primary current injection:
 - 1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.
 - f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
 - g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
 - h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
 - i. Verify operation of charging mechanism. Investigate units that do not function as designed.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 4. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

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5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.
 1. Test procedures used.
 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
 3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.07 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

END OF SECTION

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SECTION 26 32 13 - ENGINE GENERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged engine generator system and associated components and accessories:
 - 1. Engine and engine accessory equipment.
 - 2. Alternator (generator).
 - 3. Generator set control system.
 - 4. Generator set enclosure.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 231113 - Facility Fuel-Oil Piping:
 - 1. Diesel fuel piping.
- C. Section 235100 - Breechings, Chimneys, and Stacks: Engine exhaust piping.
- D. Section 260526 - Grounding and Bonding for Electrical Systems.
- E. Section 260529 - Hangers and Supports for Electrical Systems.
- F. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. ASTM D975 - Standard Specification for Diesel Fuel 2020b.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA/EGSA 404 - Standard for Installing Generator Sets 2014.
- D. NEMA MG 1 - Motors and Generators 2018.
- E. NFPA 99 - Health Care Facilities Code 2018.
- F. NFPA 110 - Standard for Emergency and Standby Power Systems 2019.
- G. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids Current Edition, Including All Revisions.
- H. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries Current Edition, Including All Revisions.
- I. UL 2200 - Stationary Engine Generator Assemblies Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Packaged Engine Generator Set - Basis of Design: Generac.
- B. Packaged Engine Generator Set - Other Acceptable Manufacturers:
 - 1. Caterpillar Inc: www.cat.com/#sle.
 - 2. Cummins Power Generation Inc: www.cumminspower.com/#sle.
 - 3. Kohler Co: www.kohlerpower.com/#sle.
- C. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
- D. Source Limitations: Furnish engine generator sets and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 PACKAGED ENGINE GENERATOR SYSTEM

- A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

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- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. System Description:
 - 1. Application: Emergency/standby.
 - 2. Configuration: Single packaged engine generator set operated independently (not in parallel).
- D. Packaged Engine Generator Set:
 - 1. Type: Diesel (compression ignition).
 - 2. Power Rating: As indicated on drawings, standby.
 - 3. Voltage: As indicated on drawings.
- E. Generator Set General Requirements:
 - 1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
 - 2. Factory-assembled, with components mounted on suitable base.
 - 3. List and label engine generator assembly as complying with UL 2200.
 - 4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
 - 5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
- F. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.
- G. Starting and Load Acceptance Requirements:
 - 1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
 - 2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
 - 3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
 - 4. Maximum Load Step: Supports 100 percent of rated load in one step.
- H. Exhaust Emissions Requirements:
 - 1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
 - 2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.
- I. Sound Level Requirements:
 - 1. Do not exceed 72 dBA when measured at 23 feet (7 m) from generator set in free field (no sound barriers) while operating at full load; include manufacturer's sound data with submittals.

2.03 ENGINE AND ENGINE ACCESSORY EQUIPMENT

- A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.
- B. Engine Fuel System - Diesel (Compression Ignition):
 - 1. Fuel Source: Diesel, ASTM D975 No. 2-D or approved cold weather diesel blends.
 - 2. Fuel Storage: Sub-base fuel tank.
 - 3. Engine Fuel Supply: Provide engine-driven, positive displacement fuel pump with replaceable fuel filter(s), water separator, check valve to secure prime, manual fuel priming pump, and relief-bypass valve. Provide fuel cooler where recommended by manufacturer.
 - 4. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
 - 5. Sub-Base Fuel Tank:
 - a. Provide sub-base mounted, double-wall fuel tank with secondary containment; listed and labeled as complying with UL 142.

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- b. Tank Capacity: Size for minimum of 24 hours of continuous engine generator operation at 100 percent rated load, but not larger than permissible by applicable codes.
 - c. Features:
 - 1) Direct reading fuel level gauge.
 - 2) Normal atmospheric vent.
 - 3) Emergency pressure relief vent.
 - 4) Fuel fill opening with lockable cap.
 - 5) Dedicated electrical conduit stub-up area.
- C. Engine Starting System:
 - 1. System Type: Electric, with DC solenoid-activated starting motor(s).
 - 2. Battery(s):
 - a. Battery Type: Lead-acid.
 - b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
 - c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
 - 3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
 - 4. Battery Charger:
 - a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
 - b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
 - c. Recognized as complying with UL 1236.
 - d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
 - e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
 - f. Provide alarm output contacts as necessary for alarm indications.
- D. Engine Speed Control System (Governor):
 - 1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
 - 2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.
- E. Engine Lubrication System:
 - 1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.
- F. Engine Cooling System:
 - 1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
 - 2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.
- G. Engine Air Intake and Exhaust System:
 - 1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
 - 2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.

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2.04 ALTERNATOR (GENERATOR)

- A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.
- B. Exciter:
 - 1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
 - 2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
 - 3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.
- C. Temperature Rise: Comply with UL 2200.
- D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.
- E. Enclosure: NEMA MG 1, drip-proof.
- F. Total Harmonic Distortion: Not greater than five percent.

2.05 GENERATOR SET CONTROL SYSTEM

- A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.
- B. Control Panel:
 - 1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
 - 2. Generator Set Control Functions:
 - a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
 - b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
 - c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
 - d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
 - e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
 - f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
 - g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.
 - 3. Generator Set Status Indications:
 - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
 - b. Current (Amps): For each phase.
 - c. Frequency (Hz).
 - d. Real power (W/kW).
 - e. Reactive power (VAR/kVAR).
 - f. Apparent power (VA/kVA).
 - g. Power factor.
 - h. Duty Level: Actual load as percentage of rated power.
 - i. Engine speed (RPM).
 - j. Battery voltage (Volts DC).
 - k. Engine oil pressure.
 - l. Engine coolant temperature.
 - m. Engine run time.
 - n. Generator powering load (position signal from transfer switch).
 - 4. Generator Set Protection and Warning/Shutdown Indications:
 - a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
 - 1) Overcrank (shutdown).
 - 2) Low coolant temperature (warning).
 - 3) High coolant temperature (warning).

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- 4) High coolant temperature (shutdown).
- 5) Low oil pressure (shutdown).
- 6) Overspeed (shutdown).
- 7) Low fuel level (warning).
- 8) Low coolant level (warning/shutdown).
- 9) Generator control not in automatic mode (warning).
- 10) High battery voltage (warning).
- 11) Low cranking voltage (warning).
- 12) Low battery voltage (warning).
- 13) Battery charger failure (warning).
- b. In addition to NFPA 110 requirements, provide the following protections/indications:
 - 1) High AC voltage (shutdown).
 - 2) Low AC voltage (shutdown).
 - 3) High frequency (shutdown).
 - 4) Low frequency (shutdown).
 - 5) Overcurrent (shutdown).
- c. Provide contacts for local and remote common alarm.
- d. Provide lamp test function that illuminates all indicator lamps.
5. Other Control Panel Features:
 - a. Event log.
- C. Remote Annunciator:
 1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.
 2. Generator Set Status Indications:
 - a. Generator powering load (via position signal from transfer switch).
 - b. Communication functional.
 3. Generator Set Warning/Shutdown Indications:
 - a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following indications:
 - 1) Overcrank (shutdown).
 - 2) Low coolant temperature (warning).
 - 3) High coolant temperature (warning).
 - 4) High coolant temperature (shutdown).
 - 5) Low oil pressure (shutdown).
 - 6) Overspeed (shutdown).
 - 7) Low fuel level (warning).
 - 8) Low coolant level (warning/shutdown).
 - 9) Generator control not in automatic mode (warning).
 - 10) High battery voltage (warning).
 - 11) Low cranking voltage (warning).
 - 12) Low battery voltage (warning).
 - 13) Battery charger failure (warning).
 - b. Provide audible alarm with silence function.
 - c. Provide lamp test function that illuminates all indicator lamps.

2.06 GENERATOR SET ENCLOSURE

- A. Enclosure Type: Sound attenuating, weather protective.
- B. Enclosure Material: Steel or aluminum.
- C. Hardware Material: Stainless steel.
- D. Color: Manufacturer's standard.
- E. Access Doors: Lockable, with all locks keyed alike.
- F. Openings: Designed to prevent bird/rodent entry.

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- G. External Drains: Extend oil and coolant drain lines to exterior of enclosure for maintenance service.
- H. Sound Attenuating Enclosures: Line enclosure with non-hydroscopic, self-extinguishing sound-attenuating material.

2.07 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Perform production tests on generator sets at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.
- C. Diesel Fuel Storage Tanks: Perform pressurized leak test prior to shipment.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of generator sets and auxiliary equipment are consistent with the indicated requirements.
- C. Verify that rough-ins for field connections are in the proper locations.
- D. Verify that mounting surfaces are ready to receive equipment.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.
- D. Arrange equipment to provide minimum clearances and required maintenance access.
- E. Unless otherwise indicated, mount generator set on properly sized, minimum 6 inch (150 mm) high concrete pad constructed in accordance with Section 033000.
- F. Provide required support and attachment in accordance with Section 260529.
- G. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.
- H. Provide diesel fuel piping and venting in accordance with Section 231113, where not factory installed.
- I. Provide engine exhaust piping in accordance with Section 235100, where not factory installed.
 - 1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
 - 2. Do not exceed manufacturer's maximum back pressure requirements.
- J. Provide grounding and bonding in accordance with Section 260526.
- K. Identify system wiring and components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.
- C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- D. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.
- E. Preliminary inspection and testing to include, at a minimum:
 - 1. Inspect each system component for damage and defects.
 - 2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
 - 3. Check for proper oil and coolant levels.

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- F. Prepare and start system in accordance with manufacturer's instructions.
- G. Provide field emissions testing where necessary for certification.
- H. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 PROTECTION

- A. Protect installed engine generator system from subsequent construction operations.

3.06 MAINTENANCE

- A. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of engine generator system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

END OF SECTION

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SECTION 26 33 23.11 - CENTRAL BATTERY EQUIPMENT FOR EMERGENCY LIGHTING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes the following central battery and power conversion equipment rated 600 V and less for emergency lighting:
 - 1. Interruptible (slow-transfer) central battery equipment.
 - 2. Interruptible (fast-transfer) central battery equipment.
 - 3. Uninterruptible (UPS-type) central battery equipment.
- B. Related Requirements:
 - 1. Section 263353 "Static Uninterruptible Power Supply" for power conversion equipment (UPS), with central batteries, not used for emergency lighting.

1.02 DEFINITIONS

- A. DDC: Direct digital control.
- B. IBC: International Building Code.
- C. Interruptible: As used in the Section Text, an off-line, passive-standby or line-interactive, inverter-only unit, with an intentional interruption of power to the load until an internal transfer switch picks up and transfers the load to the unit's inverter and internal battery source on loss of the "normal" source, and then retransfers to the "normal" source when it is restored. Transfer time can be "slow" (up to approximately 1 second) or "fast" (2-4 ms or 40-50 ms, depending on manufacturer).
- D. LED: Light-emitting diode.
- E. 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.
- F. NiCd: Nickel cadmium.
- G. OCPD: Overcurrent protective device.
- H. PC: Personal computer.
- I. PWM: Pulse-width modulated.
- J. TDD: Total demand (harmonic current) distortion (also listed as "THD" in catalog data by manufacturers).
- K. THD(V): Total harmonic voltage demand.

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- L. Uninterruptible: As used in the Section Text, an on-line, double-conversion (rectifier/inverter) unit, with no interruption of power to the load on interruption and restoration of the "normal" source.
- M. UPS: Uninterruptible power supply.
- N. VRLA: Valve-regulated lead acid.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type and rating of central battery equipment unit.
 - 1. Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, shipping splits, and furnished options, specialties, and accessories.
- B. Shop Drawings: For each type and rating of central battery equipment unit.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, ventilation requirements, method of field assembly, components, and location and size of each field connection.
 - 3. Include system one-line diagram, internal and interconnecting wiring; and diagrams for power, signal, and control wiring.
 - 4. Include elevation, details, and legends of control and indication displays.
 - 5. Include -circuit current (withstand) rating of unit.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings:
 - 1. Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around central battery equipment. Show central battery equipment layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
 - 2. Provide 1/4" scale drawing demonstrating that installation has been coordinated with work of other trades. Use actual dimensions from approved equipment submittals to coordinate layout and installation of Inverter, battery cabinet and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Qualification Data: Fortesting agency.
- C. Seismic Qualification Data: For central battery equipment, accessories, and components, from manufacturer.
 - 1. Certificate of compliance.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

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- D. Product Certificates: For each type of central battery equipment.
- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For central battery equipment to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing central battery equipment.
 - b. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
 - c. Manufacturer's written instructions for selecting and setting field-adjustable controls and status and alarm points

1.06 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. Deliver extra materials to Owner.
 - 1. Fuses: One for every 10 of each type and rating, but no fewer than 3 of each type.
 - 2. Output Circuit Breakers: One for every 10 of each type and rating, but no fewer than 3 of each type.
 - 3. Output Circuit Breaker Open/Tripped Alarm Contacts: One for every 10 supplied, but no fewer than 3 of each type.
 - 4. Cabinet Ventilation Filters: One complete set.
 - 5. Circuit Board: One spare circuit board for each critical circuit.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: Member company of NETA or an NRTL acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver equipment in fully enclosed vehicles.
- B. Store equipment in spaces having environments controlled within manufacturers' written instructions for ambient temperature and humidity conditions for non-operating equipment.

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1.09 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
1. Ambient Temperature: Less than 0 deg F (minus 18 deg C) or exceeding 104 deg F (40 deg C), with an average value exceeding 95 deg F (35 deg C) over a 24-hour period.
 2. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C).
 3. Humidity: More than 95 percent (condensing).
 4. Altitude: Exceeding 3300 feet (1000 m).
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for central battery equipment, including clearances between central battery equipment and adjacent surfaces and other items.

1.10 COORDINATION

- A. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace central battery equipment that fails in materials or workmanship within specified warranty period. Special warranty, applying to batteries only, applies to materials only, on a prorated basis, for period specified.
1. Warranty Period: Include the following warranty periods, from date of Substantial Completion:
 - a. Premium VRLA Batteries:
 - 1) Full Warranty: One year(s).
 - 2) Pro Rata: 19 years.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Central battery equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. The designated central battery equipment shall be tested and certified by an NRTL as meeting ICC-ES AC 156 test procedure requirements.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.02 INTERRUPTIBLE (FAST-TRANSFER) CENTRAL BATTERY EQUIPMENT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Chloride Systems.
 2. Controlled Power Company; an Emerson company.

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3. Cooper Industries, Inc.
4. Dual-Lite.
5. Emergi-Lite; a Thomas & Betts brand.
6. Lithonia Lighting; Acuity Brands Lighting, Inc.
7. Myers Power Products, Inc.
8. Siltron Emergency Systems.
9. Thomas & Betts Corporation; A Member of the ABB Group.

B. General Requirements for Interruptible (Fast-Transfer) Central Battery Equipment:

1. 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.
2. NRTL Compliance: Fabricate and label central battery equipment to comply with UL 924.
3. Comply with the IBC, NFPA 70, and NFPA 101.

C. Performance Requirements:

1. Fast-Transfer Central Battery Equipment: Passive standby (off-line) system. Automatically sense loss of normal ac supply and use a solid-state static switch to transfer load. Transfer in 2-4 ms or less from normal supply to battery-inverter supply.
2. Automatic Operation:
 - a. Normal Conditions: Supply the load with ac power flowing from normal ac power input terminals, bypassing inverter, with battery connected in parallel via rectifier/charger output.
 - b. Abnormal Supply Conditions: If normal ac supply deviates from specified voltage, transfer switch operates and battery supplies constant, regulated ac power through the inverter to the load, with a momentary loss of power to the load.
 - c. If normal power fails, transfer switch operates and battery supplies constant, regulated ac power through the inverter to the load, with a momentary loss of power to the load.
 - d. If a fault occurs in system when being supplied by inverter and current flows in excess of the overload rating of inverter, inverter automatically protects itself against damage from overloads and short circuits by shutting down.
 - e. When normal ac power is restored at input supply terminals of unit, controls automatically retransfer the load back to the normal ac supply, with a momentary loss of power to the load. Rectifier/charger then recharges battery.
 - f. If normal power failure is prolonged (more than 90 minutes), integral low-voltage battery protective circuit disconnects battery and prevents battery from damage due to deep discharge.
 - g. If battery becomes discharged, and when normal ac supply is again available, rectifier/charger recharges battery. When battery is fully charged, rectifier/charger automatically shifts to float-charge mode.
 - h. If battery is disconnected, and normal ac power is available, central battery equipment continues to supply power to the load with no degradation of its regulation of voltage and frequency of output bus.

D. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus 15 percent of central battery equipment input voltage rating.

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2. Input Frequency Tolerance: Plus or minus 3 percent of central battery equipment frequency rating.
 3. Synchronizing Slew Rate: 1 Hz per second, maximum.
 4. Minimum Off-Line Efficiency: 99 percent at 60 Hz, full load.
 5. Minimum Displacement Primary-Side Power Factor: 96 Insert number percent under any load or operating condition.
 6. Ambient Temperature Rating (Other Than Batteries): Not less than 68 deg F (20 deg C) and not exceeding 86 deg F (30 deg C).
 7. Ambient Storage Temperature Rating (Other Than Batteries): Not less than minus 4 deg F (minus 20 deg C) and not exceeding 158 deg F (70 deg C).
 8. Ambient Temperature Rating (Batteries): Not less than 32 deg F (0 deg C) and not exceeding 104 deg F (40 deg C).
 9. Ambient Storage Temperature Rating (Batteries): Not less than 0 deg F (minus 18 deg C) and not exceeding 104 deg F (40 deg C).
 10. Humidity Rating: Less than 95 percent (noncondensing).
 11. Altitude Rating: Not exceeding 3300 feet (1005 m).
 12. Off-Line Overload Capability: 1.5 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
- E. Inverter and Controls Logic: Microprocessor based, isolated from all power circuits; provides complete self-diagnostics, periodic automatic testing and reporting; with alarms.
- F. Controls and Indication:
1. Status Indication: Door-mounted, labeled LED indicators or digital screen displaying the following conditions:
 - a. Normal power available.
 - b. Status of system.
 - c. Battery charging status.
 - d. On battery power.
 - e. System fault.
 - f. External fault.
 2. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.
 - a. Keypad: In addition to required programming and control keys, include the following:
 - 1) Keys for METER, CONTROL, PROGRAM, and CLEAR modes.
 - 2) Security Access: Provide electronic security access to controls through identification and password with at least two levels of access: View only; and view, operate, and service.
 - 3) Control Authority: Supports at least three conditions: Off, local manual control at unit and local automatic control at unit.
 - b. Digital Display: Plain-English language messages on a digital display; provide the following historical logging information and displays:
 - 1) Real-time clock with current time and date.
 - 2) Tests and Events Logs: Record and store up to 50 tests and events.
 - a) Dates.
 - b) Times.

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- c) Durations.
 - d) Output voltage and currents.
 - 3) Alarm Logs: Record and store up to 50 alarms.
 - a) Dates.
 - b) Times.
 - c) Alarm type.
 - 4) Metering Functions: Display central battery equipment metering parameters including, but not limited to, the following:
 - a) Input and output voltage (V ac) and output current (A ac).
 - b) Battery voltage (V dc) and current (A ac).
 - c) Fault or alarming status (code).
 - d) Power output (VA).
 - e) Inverter load (W).
 - f) Ambient temperature (deg F).
 - g) System run time (cumulative days).
 - h) Inverter run time (cumulative minutes).
 - 5) Alarm Functions: Digital display mounted flush in unit door and connected to display central battery equipment parameters including, but not limited to, the following:
 - a) High/low battery charge voltage.
 - b) High/low input voltage.
 - c) Battery nearing low-voltage condition.
 - d) Battery low voltage.
 - e) High ambient temperature.
 - f) Inverter fault.
 - g) Output fault.
 - h) Output overload.
- 3. Remote Signal Interfaces:
 - a. Remote Indication Interface: A minimum of one programmable (Form C) dry-circuit relay output(s) (120-V ac, 2 A) for remote indication of the following:
 - 1) Fault or status indication.
 - 2) On bypass.
 - 3) Low battery.
 - 4) Insert indication.
 - b. Communications Interface: Factory-installed hardware and software to enable a remote PC to program central battery equipment and monitor and display status and alarms.
 - 1) Communications Ports: **RS-232] [RS-485]**
 - 2) Network Communications Ports: **[Ethernet] [and] [RS-232] [RS-485] <Insert port type>.**
 - 3) Compliance with ASHRAE 135: Controllers shall support serial MS/TP and Ethernet IP communications, and shall be able to communicate directly via DDC system for HVAC RS-485 serial networks and Ethernet 10Base-T networks as a native device.

G. Self-Protection and Reliability Features:

- 1. Input transient protection by means of surge suppressors to provide protection against damage from supply voltage surges as defined in IEEE C62.45, Category B and C.

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2. Integral, programmable, self-diagnostic and self-test circuitry; with alarms and logging.
 3. Battery deep-discharge and self-discharge protection; with alarms.
 4. Battery self-test circuitry; with alarms and logging.
- H. Integral Input Disconnecting Means and OCPD: Thermal-magnetic circuit breaker, complying with UL 489.
1. Integrated Equipment Minimum Short-Circuit Current (Withstand) Rating: As indicated on plans and in compliance with section 260572 Overcurrent Protective Device Short-Circuit Study.
- I. Inverter:
1. Description: Solid-state, high-frequency, PWM type, with the following operational features:
 - a. Automatically regulate output voltage to within plus or minus 3 percent, for all load ranges and for maximum 25 percent step-load changes; regulation may increase to 8 percent for 100 percent step-load changes.
 - b. Automatically regulate output frequency to within plus or minus 1 Hz, from no load to full load, at unity power factor, over the operating range of battery voltage.
 - c. Output Voltage Waveform: Sine wave with maximum 3 percent TDD throughout battery operating-voltage range, for 100 percent linear load.
 - d. Inverter Overload Capability: 115 percent for 10 minutes; 150 percent surge for 10 seconds.
 - e. Load Power Factor: 0.5 lead to 0.5 lag.
 - f. Brownout Protection: Produces rated power without draining batteries when input voltage is down to 75 percent of normal.
- J. Rectifier/Battery Charger:
1. Description: Solid state, variable rate, temperature compensated; automatically maintains batteries in fully charged condition when normal power is available.
 2. Maximum Battery Recharge Time from Fully Discharged State: 24 hours.
 3. Low-voltage disconnect circuit reduces battery discharge during extended power outages, monitors battery voltage, and disconnects inverter when battery voltage drops to no less than 85.7 percent of nominal voltage.
- K. Batteries:
1. Description: Premium VRLA batteries.
 - a. Capable of sustaining full-capacity output of inverter unit for minimum of 90 minutes.
 2. Battery Disconnect and OCPD: Manufacturer's standard.
- L. Maintenance Bypass Systems:
1. Maintenance Bypass Mode: Internal; manual operation only; bypasses central battery equipment power circuits (inverter and static transfer switch); requires local operator selection at central battery equipment. Transfer and retransfer shall be make-before-break, without disrupting power to the load or causing system instabilities.
 2. Bypass Overload Capability: 1.5 times the base load current.
- M. Integral Output Disconnecting Means and OCPD:

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1. Single-Output OCPD: Thermal-magnetic circuit breaker, complying with UL 489; manufacturer's standard ratings based on unit output ratings.
2. Multiple-Output OCPDs: Thermal-magnetic circuit breakers, complying with UL 489; voltage rating matching unit output voltage rating; 20 A, single pole.
 - a. Normally Closed: 2; with trip alarm.
 - b. Normally Open: 2; with trip alarm.

2.03 ENCLOSURES

- A. Central Battery Equipment Enclosures: NEMA 250, to comply with environmental conditions at installed location.
 1. Dry and Clean Indoor Locations: Type 1 steel cabinets with access to components through hinged doors with flush tumbler lock and latch.
 2. Finish: Manufacturer's standard baked-enamel finish over corrosion-resistant prime treatment.

2.04 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate central battery equipment fabricator's quality-control and testing methods.
- B. Testing: Test and inspect central battery equipment according to UL 924.
- C. Factory Tests: Test and inspect assembled central battery equipment, by a qualified testing agency, according to UL 924. Affix standards organization's label. Include the following:
 1. Functional test and demonstration of all functions, controls, indicators, sensors, and protective devices.
 2. Full-load test.
 3. Transient-load response test.
 4. Overload test.
 5. Power failure test.
- D. Central battery equipment will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Receive, inspect, handle, and store central battery equipment according to NECA 411.
- B. Examine areas, surfaces, and substrates to receive central battery equipment, with Installer present, for compliance with requirements for installation tolerances, structural support, ventilation, temperature, humidity, and other conditions affecting performance of the Work.
 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment will be installed, before installation begins.

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- C. Examine equipment before installation. Reject equipment that is wet, moisture damaged, or mold damaged.
- D. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Coordinate layout and installation of central battery equipment with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install central battery equipment and accessories according to NECA 411.
- C. Wall-Mounted Central Battery Equipment: Install central battery equipment on walls with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For units not on walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."
- D. Seismic Bracing: Comply with requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- F. Comply with NECA 1.
- G. Wiring Method: Conceal conductors and cables in raceway in accessible ceilings, walls, and floors where possible.
- H. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.03 CONNECTIONS

- A. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams unless otherwise indicated.
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. Separately Derived Systems: Make grounding connections to grounding electrodes and bonding connections to metallic piping systems as indicated; comply with NFPA 70.

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- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.04 CONTROL WIRING INSTALLATION

- A. Install wiring between central battery equipment and remote devices and facility's central-control system. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."
- B. Bundle, train, and support wiring in enclosures.

3.05 IDENTIFICATION

- A. Identify central battery equipment, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label central battery equipment with engraved nameplates.
 - 3. Label each separate cabinet, for multicabinet units.
 - 4. Label each enclosure-mounted control and pilot device.
- B. Operating Instructions: Frame printed operating instructions for central battery equipment, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of central battery equipment units.

3.06 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 test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Acceptance Testing Preparation:
 - 1. Inspect and Test Each Component:
 - a. Inspect wiring, components, connections, and equipment installations. Test and adjust components and equipment.
 - b. Test insulation resistance for all external branch circuit, feeder, control, and alarm wiring connected to central battery equipment element and component.
 - c. Test continuity of each circuit.
- E. Tests and Inspections:
 - 1. Inspect central battery equipment, wiring, components, connections, and equipment installation. Test and adjust components and equipment.
 - 2. Test insulation resistance for all external branch circuit, feeder, control, and alarm wiring connected to central battery equipment element and component.
 - 3. Test continuity of each circuit.

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4. Verify that input voltages and frequencies at central battery equipment locations are within voltage and frequency limits specified in Part 2. If outside this range, notify Construction Manager before closing input OCPDs.
5. Perform each visual and mechanical inspection and electrical test stated in manufacturer's written instructions and in NETA Acceptance Testing Specification, including specifically those for batteries, battery chargers, and UPS, regardless of the type of central battery equipment provided. Certify compliance with test parameters.
6. Perform a load-duration test at rated voltage and rated output current to verify the correct functional operation of the unit under full-load stable operating conditions for the minimum time limits required by UL 924. Monitor and record ambient temperature and temperatures within the unit.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of central battery equipment. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of central battery equipment 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Central battery equipment will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies central battery equipment and describes all test results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.07 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.

3.08 ADJUSTING

- A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.
- B. Set field-adjustable switches, auxiliary relays, and other adjustable parts.
- C. Adjust the trip settings of thermal-magnetic circuit breakers with adjustable, instantaneous-trip elements; install fuses if not factory installed.

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- D. Set the automatic system test parameters.
- E. Set field-adjustable, circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

3.09 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.
- B. Replace central battery equipment whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain central battery equipment, and to use and reprogram microprocessor-based control, monitoring, and display functions.

END OF SECTION

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SECTION 263600 TRANSFER SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:
 - 1. Automatic transfer switches.
 - 2. Includes service entrance rated transfer switches.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 260573 - Power System Studies: Additional criteria for the selection of equipment specified in this section.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NEMA ICS 10 Part 1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment 2020.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 110 - Standard for Emergency and Standby Power Systems 2019.
- G. UL 1008 - Transfer Switch Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.
 - 2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Coordinate the work with placement of supports, anchors, etc. required for mounting.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.
- C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
- D. Manufacturer's equipment seismic qualification certification.

1.06 QUALITY ASSURANCE

- A. Comply with the following:

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1. NFPA 70 (National Electrical Code).
 2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 2 system.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store transfer switches in accordance with manufacturer's instructions.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's instructions to avoid damage to transfer switch components, enclosure, and finish.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Transfer Switches - Basis of Design: Generac.
- B. Transfer Switches - Other Acceptable Manufacturers:
 1. Same as manufacturer of engine generator(s) used for this project.
- C. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
- D. Source Limitations: Furnish transfer switches and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 TRANSFER SWITCHES

- A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Applications:
- D. Construction Type: Either "contactor type" (open contact) or "breaker type" (enclosed contact) transfer switches complying with specified requirements are acceptable.
- E. Automatic Transfer Switch:
- F. Comply with NEMA ICS 10 Part 1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).
- G. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.
- H. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.
- I. Switching Methods:
 1. Open Transition:
 - a. Provide break-before-make transfer without a neutral position that is not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.

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<div>2. Obtain control power for transfer operation from line side of source to which the load is to be transferred.</div> <div>J. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.</div> <div>K. Enclosures:<div>1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:<div>a. Indoor Clean, Dry Locations: Type 1 or Type 12.</div></div><div>2. Finish: Manufacturer's standard unless otherwise indicated.</div></div> <div>L. Short Circuit Current Rating:<div>1. Withstand and Closing Rating: Provide transfer switches, when protected by the supply side overcurrent protective devices to be installed, with listed withstand and closing rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.</div></div> <div>M. Automatic Transfer Switches:<div>1. Description: Transfer switches with automatically initiated transfer between sources; electrically operated and mechanically held.</div><div>2. Control Functions:<div>a. Automatic mode.</div><div>b. Test Mode: Simulates failure of primary/normal source.</div><div>c. Voltage and Frequency Sensing:<div>1) Undervoltage sensing for each phase of primary/normal source; adjustable dropout/pickup settings.</div><div>2) Undervoltage sensing for alternate/emergency source; adjustable dropout/pickup settings.</div><div>3) Underfrequency sensing for alternate/emergency source; adjustable dropout/pickup settings.</div></div><div>d. Outputs:<div>1) Contacts for engine start/shutdown (except where direct generator communication interface is provided).</div><div>2) Auxiliary contacts; one set(s) for each switch position.</div></div><div>e. Adjustable Time Delays:<div>1) Engine generator start time delay; delays engine start signal to override momentary primary/normal source failures.</div><div>2) Transfer to alternate/emergency source time delay.</div><div>3) Retransfer to primary/normal source time delay.</div><div>4) Engine generator cooldown time delay; delays engine shutdown following retransfer to primary/normal source to permit generator to run unloaded for cooldown period.</div></div><div>f. In-Phase Monitor (Open Transition Transfer Switches): Monitors phase angle difference between sources for initiating in-phase transfer.</div><div>g. Engine Exerciser: Provides programmable scheduled exercising of engine generator selectable with or without transfer to load; provides memory retention during power outage.</div></div></div> <div>3. Status Indications:<div>a. Connected to alternate/emergency source.</div><div>b. Connected to primary/normal source.</div><div>c. Alternate/emergency source available.</div></div> <div>4. Automatic Sequence of Operations:<div>a. Upon failure of primary/normal source for a programmable time period (engine generator start time delay), initiate starting of engine generator where applicable.</div><div>b. When alternate/emergency source is available, transfer load to alternate/emergency source after programmable time delay.</div><div>c. When primary/normal source has been restored, retransfer to primary/normal source after a programmable time delay. Bypass time delay if alternate/emergency source fails and primary/normal source is available.</div></div>		
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- d. Where applicable, initiate shutdown of engine generator after programmable engine cooldown time delay.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.
- C. Verify that rough-ins for field connections are in the proper locations.
- D. Verify that mounting surfaces are ready to receive transfer switches.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install transfer switches plumb and level.
- F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 033000.
- G. Provide grounding and bonding in accordance with Section 260526.
- H. Identify transfer switches and associated system wiring in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Prepare and start system in accordance with manufacturer's instructions.
- C. Automatic Transfer Switches:
 - 1. Inspect and test in accordance with NETA ATS, except Section 4.
 - 2. Perform inspections and tests listed in NETA ATS, Section 7.22.3. The insulation-resistance tests listed as optional are not required.
- D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

- A. Training: Train Owner's personnel on operation, adjustment, and maintenance of transfer switches.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.06 PROTECTION

- A. Protect installed transfer switches from subsequent construction operations.

END OF SECTION

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SECTION 26 51 19 - LED INTERIOR LIGHTING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes the following types of LED luminaires:
 - 1. Materials.
 - 2. Finishes.
 - 3. Luminaire support.
- B. Related Requirements:
 - 1. Section 260923.02 "Lighting Controls System" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

1.02 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaires.
 - 4. Include emergency lighting units, including batteries and chargers.
 - 5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
 - 6. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-80.
 - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

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- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing laboratory providing photometric data for luminaires.
- B. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- C. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Product Certificates: For each type of luminaire.
- E. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- F. Sample warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.06 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. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

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1.07 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.09 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.02 LUMINAIRE REQUIREMENTS

- 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. Standards:
 - 1. ENERGY STAR certified.
 - 2. California Title 24 compliant.
 - 3. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
 - 4. for indicated class and division of hazard by FM Global.
 - 5. UL Listing: Listed for damp location.

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6. Recessed luminaires shall comply with NEMA LE 4.
7. User Replaceable Lamps:
 - a. Bulb shape complying with ANSI C78.79.
 - b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

C. Lamps dimmable from 100 percent to 0 percent of maximum light output.

D. Internal driver.

2.03 MATERIALS

- A. Metal Parts:
 1. Free of burrs and sharp corners and edges.
 2. Sheet metal components shall be steel unless otherwise indicated.
 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI for all luminaires.

2.04 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.05 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, [12 gage (2.68 mm)]
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

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- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.03 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
1. Sized and rated for luminaire weight.
 2. Able to maintain luminaire position after cleaning and relamping.
 3. Provide support for luminaire without causing deflection of ceiling or wall.
 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaire Support:
1. Secured to outlet box.
 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaire Support:
1. Attached to structural members in walls.
 2. Do not attach luminaires directly to gypsum board.
- G. Suspended Luminaire Support:
1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.

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2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and [wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

- H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.04 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

3.06 STARTUP SERVICE

- A. Comply with requirements for startup specified in Section 260923.02 "Lighting Control System."

3.07 ADJUSTING

- A. Occupancy Adjustments: When requested within 12months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

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SECTION 26 56 13 - LIGHTING POLES AND STANDARDS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Poles and accessories for support of luminaires.

1.02 DEFINITIONS

- A. EPA: Equivalent projected area.
- B. Luminaire: Complete luminaire.
- C. Pole: Luminaire-supporting structure, including tower used for large-area illumination.
- D. Standard: See "Pole."

1.03 ACTION SUBMITTALS

- A. Product Data: For each pole, accessory, and luminaire-supporting and -lowering device, arranged as indicated.
 - 1. Include data on construction details, profiles, EPA, cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.
 - 2. Include finishes for lighting poles and luminaire-supporting devices.
 - 3. Anchor bolts.
 - 4. Manufactured pole foundations.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Detail fabrication and assembly of poles and pole accessories.
 - 4. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the state of installation.
 - 5. Anchor bolt templates keyed to specific poles and certified by manufacturer.
 - 6. Method and procedure of pole installation. Include manufacturer's written installations.

1.04 INFORMATIONAL SUBMITTALS

- A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.

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- B. Source quality-control reports.
- C. Sample Warranty: Manufacturer's standard warranty.
- D. Soil test reports

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For poles to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include pole inspection and repair procedures.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Pole repair materials.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Package aluminum poles for shipping according to ASTM B 660.
- B. Store poles on decay-resistant skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- C. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

1.08 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of pole(s) that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
 - 2. Warranty Period for Corrosion Resistance: Five years from date of Substantial Completion.
 - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Foundation and pole shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

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2. Component Importance Factor: 1.5.
- B. Structural Characteristics: Comply with AASHTO LTS-6-M.
- C. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied according to AASHTO LTS-6-M.
- D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied according to AASHTO LTS-6-M.
 1. Basic wind speed for calculating wind load for poles exceeding 50 feet (15 m) in height is 90 mph (40 m/s)
 - a. Wind Importance Factor: 1.0
 - b. Minimum Design Life: 50 years
 - c. Velocity Conversion Factor: 1.0
 2. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 100 mph (45 m/s)
 - a. Wind Importance Factor: 1.0
 - b. Minimum Design Life: 25 years
 - c. Velocity Conversion Factor: 1.0
- E. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of 1.1 to obtain the EPA to be used in pole selection strength analysis.
- F. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

2.02 ALUMINUM POLES

- A. Subject to compliance with requirements, provide products by one of the following:
 1. Guardco
 2. American LitePole.
 3. Bridgewell Resources.
 4. Cooper Lighting, an Eaton business.
 5. E-conolight.
 6. EGS/Appleton Electric.
 7. H.E. Williams.
 8. Hapco.
 9. Hubbell Incorporated.
 10. KIM Lighting.
 11. LSI Industries.
 12. Ruud Lighting Direct.
- B. Poles: Seamless, extruded structural tube complying with ASTM B 221, Alloy 6061-T6, with access handhole in in pole wall.
 1. Shape: Round, straight
 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

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- C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- D. Grounding and Bonding Lugs: Bolted 1/2-inch (13-mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- E. Fasteners: Stainless steel size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.
 - 1. Materials: Compatible with poles and standards as well as to substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
- F. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.
- G. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
- H. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - 2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
 - 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected by Architect from manufacturer's full range.
- I. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - 2. Powder coat shall comply with AAMA 2604.
 - a. Electrostatic applied powder coating; single application with a minimum 2.5- to 3.5-mils dry film thickness; cured according to manufacturer's instructions. Coat interior and exterior of pole for equal corrosion protection.
 - b. Color: As selected by Architect from manufacturer's full range]

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2.03 POLE ACCESSORIES

- A. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.

2.04 MOUNTING HARDWARE

- A. Anchor Bolts: Manufactured to ASTM F 1554, Grade 55, with a minimum yield strength of 55,000 psi (380,000 kPa).
 - 1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C
 - 2. Bent rods
 - 3. Threading: Uniform National Coarse, Class 2A.
- B. Nuts: ASTM A 563, Grade A, Heavy-Hex
 - 1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C]
- C. Washers: ASTM F 436, Type 1.
 - 1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C

2.05 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine poles, luminaire-mounting devices, lowering devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.
- C. Examine roughing-in for foundation and conduit to verify actual locations of installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 POLE FOUNDATION

- A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123 M; and with top-plate and mounting bolts to match pole-base flange and

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strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

- B. Pre-Cast Foundations: Factory fabricated, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- C. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories.
 - 1. Baseplate: Stamped with manufacturer's name, date of production, and cable entry.
- D. Direct-Buried Foundations: Install to depth indicated on Drawings, but not less than one-sixth of pole height. Add backfill in 6-inch (150-mm) to 9-inch (230-mm) layers, tamping each layer before adding the next] [as shown on Drawings] <Insert requirement>. To ensure a plumb installation, continuously check pole orientation with plumb bob while tamping.
- E. Direct-Buried Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height. To ensure a plumb installation, continuously check pole orientation with plumb bob while tamping.
 - 1. Make holes 6 inches (150 mm) in diameter larger than pole diameter.
 - 2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days and finish in a dome above finished grade.
 - 3. Use a short piece of 1/2-inch (13-mm) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
 - 4. Cure concrete a minimum of 72 hours before performing work on pole.
- F. Anchor Bolts: Install plumb using manufacturer-supplied template, uniformly spaced.

3.03 POLE INSTALLATION

- A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on drawing.
 - 1. Fire Hydrants and Water Piping: 60 inches (1520 mm).
 - 2. Water, Gas, Electric, Communications, and Sewer Lines: 10 feet (3 m).
 - 3. Trees: 15 feet (5 m) from tree trunk.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level according to pole manufacturer's written instructions.

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1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
3. Install base covers unless otherwise indicated.
4. Use a short piece of 1/2 -inch (13-mm) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

- E. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch (25 mm) below top of concrete slab.
- F. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

3.04 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum using insulating fittings or treatment.
- B. Steel Conduits: Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

3.05 GROUNDING

- A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
1. Install grounding electrode for each pole unless otherwise indicated.
 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.06 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.07 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
1. Inspect poles for nicks, mars, dents, scratches, and other damage.
 2. System function tests.

END OF SECTION

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SECTION 26 56 19 – LED EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
 - 2. Luminaire supports.
 - 3. Luminaire-mounted photoelectric relays.
- B. Related Requirements:
 - 1. Section 260923.02 "Lighting Controls System" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
 - 2. Section 265613 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

1.02 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaire.
 - 4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
 - 5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.
 - a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.

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- b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
 - 6. Wiring diagrams for power, control, and signal wiring.
 - 7. Photoelectric relays.
 - 8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.
- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing laboratory providing photometric data for luminaires.
- B. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Product Certificates: For each type of the following:
 - 1. Luminaire.
 - 2. Photoelectric relay.
 - 3. Factory installed lighting control devices.
- D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- E. Source quality-control reports.
- F. Sample warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.

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1.06 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. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.07 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- E. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.09 FIELD CONDITIONS

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
- B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

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1. Failures include, but are not limited to, the following:
 - a. Structural failures, including luminaire support components.
 - b. Faulty operation of luminaires and accessories.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.02 LUMINAIRE REQUIREMENTS

- 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. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598 and listed for wet location.
- E. Lamp base complying with ANSI C81.61 or IEC 60061-1.
- F. Bulb shape complying with ANSI C79.1.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Internal driver.
- I. In-line Fusing: Separate in-line fuse for each luminaire.
- J. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.
- K. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

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2.03 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.
- D. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- E. Housings:
 - 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
 - 2. Provide filter/breather for enclosed luminaires.
- F. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage and coating.
 - c. CCT and CRI for all luminaires.

2.04 FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.

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- D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected by Architect from manufacturer's full range.

2.05 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Examine walls, roofs, and canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. Supports:

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1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.

G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.

I. Coordinate layout and installation of luminaires with other construction.

J. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.04 BOLLARD LUMINAIRE INSTALLATION:

A. Align units for optimum directional alignment of light distribution.

1. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.05 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Aim as indicated on Drawings.

B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.06 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

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3.07 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.08 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Verify operation of photoelectric controls.
- C. Illumination Tests:
 - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards.
 - 2. Coordinate "Operational Test" Subparagraph below with requirements in Section 260923 "Lighting Control Devices."
 - 3. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- D. Luminaire will be considered defective if it does not pass tests and inspections.
- E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.09 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

END OF SECTION

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SECTION 27 00 00 – COMMUNICATIONS BASIC REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-16 or 26, Basic Materials and Methods sections apply to work specified in this section.

1.02 REFERENCE STANDARDS

- A. ANSI/TIA-492.AAAB-B – Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers
- B. ANSI/TIA-492.AAAD – Detail Specification for 850-nm Laser- Optimized, 50-µm Core Diameter/125-µm Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers Suitable for Manufacturing OM4 Cabled Optical Fiber
- C. ANSI/TIA-492.CAAB – Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers with Low Water Peak. Current Edition
- D. ANSI/TIA-568.0-D – Generic Communications Cabling for Customer Premises
- E. ANSI/TIA-568.1-D-1 – Commercial Building Communications Cabling Standard
- F. ANSI/TIA-568.2-D – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
- G. ANSI/TIA-568.3-D – Optical Fiber Cabling and Components Standard
- H. ANSI/TIA-569-E – Telecommunications Pathways and Spaces
- I. ANSI/TIA-606-C – Administration Standard for the Commercial Telecommunications Infrastructure.
- J. ANSI/TIA-607-C – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
- K. ANSI/TIA-862-B-1 – Structured Cabling Infrastructure Standard for Intelligent Building Systems
- L. ANSI/TIA-942-B – Telecommunications Infrastructure Standard for Data Centers
- M. ANSI/ICEA S-90-661-2008 - Category 3, 5, and 5e Individually Unshielded Twisted Pair Indoor Cable for Use In General Purpose and LAN Communication Wiring Systems
- N. ICEA S-102-700-2004 – ICEA Standard For Category 6 Individually Unshielded Twisted Pair Indoor Cables (With Or Without An Overall Shield) For Use In Communications Wiring Systems Technical Requirements

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- O. NFPA 70 – National Electrical Code (NEC).
- P. NFPA 262 – Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
- Q. BICSI – TDM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDM)
- R. UL 444 – Standard for Safety of Communications Cable
- S. UL 1581 – Reference Standard for Electrical Wires, Cables, and Flexible Cords
- T. UL 1666 – Standard for Safety of Flame Propagation Height
- U. UL 1863 - Communications-Circuit Accessories
- V. NFPA 262 – Flame Travel and Smoke of Wires and Cables

1.03 GOVERNANCE

- A. The Electrical Code referred to in these specifications is the National Electrical Code as currently adopted by the State of California. All work will be provided in strict compliance with the Electrical Code and all regulations that may apply.
- B. Where standards exist, for a particular category, products used on this project will be listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL) and be approved or listed for the intended service and application.
- C. These specifications do not undertake to repeat the requirements of codes, regulations or NRTL listing or labeling instructions. The Specifications or Drawings may require items or work beyond the requirements of applicable codes or regulations. The stricter, higher quality, greater quantity or higher cost will be allowed, and accommodations must be approved by Owner prior to procurement or installation. It is incumbent on the Installer, material and equipment suppliers to meet these specifications, applicable codes, regulations, and NRTL listing agency restrictions.
- D. The word "Manufacturer" will include the Manufacturer, the Manufacturer's Representative, the Distributor, the Fabricator, and the Supplier of the particular classification of equipment, system, product, and material including a bundled solution branded under a single name.
- E. All work, equipment, and systems will be manufactured, provided, repaired, installed, and tested in accordance with the latest edition and all current amendments of the applicable publications and standards of the organizations listed below as of the date of the Contract Documents. When the Specification requirements exceed the requirements of these publications and standards the Specifications will govern:
 - 1. State Building Code (SBC)
 - 2. Building Department Inspectional Services
 - 3. American Society for Testing and Materials (ASTM)
 - 4. Underwriter's Laboratories, Inc. (UL)
 - 5. Insulated Cable Engineers Association (ICEA)

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6. National Electrical Manufacturers Association (NEMA)
 7. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
 8. American National Standards Institute, Inc. (ANSI)
 9. National Fire Protection Association (NFPA)
 10. Local Electric Code
 11. Department of Public Safety (DPS)
 12. Building Officials and Code Administrators International, Inc. (BOCA)
 13. Department of Labor USA. Safety and Health Regulations for Construction (OSHA)
 14. Energy Codes
 15. National Electrical Contractors Association (NECA)
 16. National Bureau of Standards (NBS)
 17. Federal Communications Commission (FCC)
 18. Utilities Serving Project.
 19. Fire Department.
 20. Americans with Disabilities Act Applications Guidelines (ADAAG).
 21. Accessibility Guidelines for Buildings and Facilities.
 22. Any and all Federal, State and Local Standards, Codes and Authorities having Jurisdiction (AHJ).
- F. In addition, all phases of the Structured Cabling System installation will adhere to applicable Local Area Network (LAN) Specifications of the IEEE, Electronics Industry Association/Telecommunications Industry Association (TIA/EIA), and Building Industry Consulting Service International (BICSI). The entire system and all components will be Nationally Recognized Testing Laboratory (NRTL) certified to appropriate TIA/EIA performance rating Category, Latest ANSI/TIA/EIA Standards 455-A, 492, 568, 569-A, 570, 606, 607 and 758 (latest revisions), and ANSI/TIA TSB 67, TSB 72, TSB 75, TSB 95 plus other standards as applicable.
- G. The Installer will have available at the job site at all times one copy of the latest edition of the Electrical Code, TIA and BICSI Standards applicable to the work as specified within this document.
- H. The above requirements will not in any way limit responsibility or requirements to comply with all other codes, standards and laws.
- I. Material, equipment, enclosures, and systems will be designed for use as required to suit the conditions, exterior or interior operation, dust tight, watertight, explosion-proof, or other special types.
- J. All materials shall be purchased from Distributors authorized by system Manufacturers to sell new and unused components.

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1.04 Definitions / Terms / Acronyms

A. Standards Bodies

1. ANSI – American Northern Standards Institute
2. AWG – American Wire Gauge
3. BICSI – Building Industry Consulting Service International
4. EIA – Electronics Industry Alliance
5. ETL – Intertek Semko Labs
6. FCC – Federal Communications Commission
7. IEC – International Electrotechnical Commission
8. IEEE – Institute of Electrical and Electronic Engineers
9. IDC – Insulation displacement contact
10. ISO – International Standards Organization
11. J-STD – Joint Standard
12. NECA – National Electrical Contractors Association
13. NFPA – National Fire Protection Agency
14. SC – Subscriber Channel
15. TIA – Telecommunications Industry Association
16. UL – Underwriters Laboratory

B. Infrastructure Terminology

1. 1GBase-T – networking protocol capable of transmitting 1 billion bits of information per second over copper twisted pair
2. 10GBase-T – networking protocol capable of transmitting 10 billion bits of information per second over copper twisted pair
3. 10GBase-SX – networking protocol capable of transmitting 10 billion bits of information per second over optical fiber at 850 nanometers
4. 8P8C Connector (Jack): A female connector that has eight pin positions and eight conductors. Jacks are typically used to terminate eight conductor category-rated cable at the user end and are inserted into faceplates to create a connection point for the user's equipment cord. Commonly referred to as "RJ45" jacks.
5. 8P8C Connector (Plug): A male connector that has eight pin positions and eight conductors. Plugs are typically used on both ends of cordage at the equipment and are inserted into faceplates or equipment to create a connection to the structured cabling. Use of a plug in structured horizontal cabling requires certification using the MPTL method of testing. Plugs may sometimes be referred to as "RJ45" plugs.

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6. CATV: Shall mean community antenna television
7. CATV Signal: Shall mean the transmission and FM transmission signal broadcast by CATV utility and received by the subscriber
8. CATV Utility: Shall mean the entity that broadcasts programmed content through a metropolitan television network to subscribers' premises
9. CM: Consolidation Point. A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
10. EMI: Electromagnetic interference
11. EO: Equipment Outlet. A device also known as the outlet or information outlet placed at the user workstation for termination using 8P8C connectors (jacks) of horizontal media for connectivity of data, voice or multimedia.
12. Headend: Shall mean the components and systems connected to (and physically near or adjacent to) the CATV Utility's demarcation point which acts as the origin of the CATV signal for premises distribution
13. IDC: Insulation displacement connector
14. LAN: Local area network
15. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.
16. RCDD: Registered Communications Distribution Designer.
17. UTP: Unshielded twisted pair
18. WAO: Work Area Outlet. See EO.
19. Cabling: The term "cabling" will mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.
20. Backbone: A facility (e.g., pathway, cable or conductors) between telecommunications rooms, or floor distribution terminals, the entrance facilities and equipment rooms within or between buildings.
21. Backbone Cabling: Cabling and connecting hardware that provides interconnections between telecommunications rooms, equipment rooms, and entrance facilities.
22. Horizontal Cabling: The cabling between and including the work area outlet/connector and the horizontal cross-connect/patch cord in the telecommunications room.
23. Telecommunications: A branch of technology concerned with the transmission, emission, and reception of signs, signals, writing, images, and sounds; that is, information, of any nature by cable, radio, optical, or other electromagnetic systems.
24. Pull Point: A Pull Point is a space used to transition between floors for backbone and horizontal cabling within a building riser system.

C. Contractual Language

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1. Construction Manager: The terms "Construction Manager" mean the Owner's appointed representative.
2. Contractor: The term "Contractor" refers to the installation Contractor responsible for the furnishing and installation of all work indicated within this Specification.
3. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
4. Furnish: The term "furnish" is used to mean "purchase, supply, provide and deliver to the Project site, protect and provide interim storage and be ready for unloading, unpacking, assembly, installation, and similar operations in accordance with Manufacturer's specifications."
5. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, rigging in place, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations".
6. Installer: The "Installer" is the Contractor, Subcontractor and/or supplier who uses their own employees for performance of all construction activity related to their specified responsibilities, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform and the "Installers" must be an authorized Manufacturers representative, certified, experienced and qualified to provide, install, program, troubleshoot, train, warrant and service all the systems in this section in their entirety.
7. If Applicable: The term "if applicable" will be that work which may be required for completed construction at applicable locations but is not necessarily shown or described in the Contract Documents.
8. As Necessary: The term "as necessary" will be that work which is required for completed construction but is not necessarily shown or described in the Contract Documents.
9. As Required: The term "as required" will be that work which is required for completed construction and is shown on the drawings or described in the project Specification.
10. Concealed: The Term "concealed" means hidden from sight, buried as in chases, furred spaces, shafts, fixed ceiling or embedded in construction.
11. Exposed: The term "exposed" means bare, open to the elements, out in the open, uncovered.
12. Product: The term "product" will mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.
13. Provide: The terms "provide" means to "furnish and install, complete and ready for the intended use".
14. "Substantial Completion" is deemed that the project is sufficiently complete to be utilized for its intended use as stated in the body of this written Specification.
15. Governmental: The term "governmental" means all municipal, state and federal government agencies.

D. Words in the singular will also mean and include the plural, wherever the context so indicates,

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and words in the plural will mean the singular, wherever the context so indicates.

1.05 DESCRIPTION OF WORK

- A. The extent of Communications system work is indicated and is hereby defined to include, but not be limited to cable, cable supports, raceway, connectors, racks, cabinets, panels, wire management, device plates, patch cords, backboard, grounding, firestop and miscellaneous items required for a complete, tested and operational system.
- B. Provide, install and test the complete cable and outlet system as indicated and described herein. Work includes procurement, project management, installation, labeling, termination, testing and cleanup of all cables installed under this project.
- C. Provide shop drawings prior to start of work for confirmation of all low voltage systems, to include rack and room plans and elevations; back board space utilization; proposed numbering syntax for panels, drop and cables; and detailed one-line diagrams of all Telecom backbone, risers, AV and Security systems.
- D. Provide system testing, as-builts (redlines) of installed cables and numbering plan, Operations & Maintenance Manuals (O&M's), and processing of warranty registration with Manufacturer upon completion of installation. As-builts shall show all actual changes to original as performed.
- E. Participation in all project coordination with General Contractor, Owner, Owners Representative, and other trades before, during and upon completion of project as necessary for a well-executed project, including any all-hands, preconstruction, weekly, and safety meetings applicable to the trades involved.
- F. Refer to other Master Division sections, bid proposal and project responsibilities matrix for responsibility and requirements for raceways, boxes and fittings, wiring devices (plates), and supporting devices, and other sections, as applicable.
- G. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
- H. Horizontal copper cabling system consists of four twisted pairs of solid annealed copper. Each four pair cable is terminated onto 8 position 8 conductor ("RJ45", or 8P8C) outlet connectors ("Jacks") using Insulation Displacement Conductors (IDCs). Color-coded connectors are placed into NEMA rated faceplates at the work area and placed into corresponding rack-mounted patch panels in the equipment / networking rooms. The jacks use state-of-the-art techniques to effectively eliminate Alien Crosstalk.
- I. Horizontal cabling may contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
- J. Bridged taps and/or splices will not be installed in the horizontal cabling.
- K. Communications cables shall be rated CMR (riser) or CMP (plenum). CMP cable ratings are required for cables passing through or contained within plenum air handling spaces, such as above drop ceilings and return or supply air shafts. The contractor is responsible for installing

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the correct cable type in the appropriate environment, and any failures to do so according to the Owner or the Authority Having Jurisdiction (AHJ) will result in the contractor removing the unsuitable cable and installing the correct cable, at their own expense.

- L. The maximum allowable horizontal cable length for balanced twisted-pair cabling installed in the permanent link (jack to jack) is 295 feet (90 m). This maximum allowable length does not include an allowance for patch cords, maximum length of 16 feet (5 m) to the workstation equipment and of 16 feet (5 m) in the horizontal cross-connect.
- M. The maximum length for RG6 cable to be installed is 50 meters for end-to-end cable runs, and 100 meters for RG11. Lengths beyond this must be approved by Owner and/or amplified correctly.

1.06 QUALITY ASSURANCE:

- A. Comply with applicable portions of NEC as to type products used and installation of components. Provide products and materials, which have been UL-listed and labeled. Comply with NEMA, ANSI and TIA standards manufacturer's recommendations for horizontal cabling.

1.07 SUBMITTALS AND SUBSTITUTIONS

- A. Products which are proposed in the bid response which are of an alternative solution are to be prequalified as "equal or better" by the Designer and Owner, in writing, prior to bid acceptance. If substitutions are allowed, they are at the discretion of the Owner and based on performance, suitability, interoperability, durability, quality, administrative requirements, warranty and other factors deemed important to the Owner.
 - 1. Written acceptance of substitutions from Owner must be included in bid package to avoid disqualification of bid as non-responsive. Nonconforming/non-specified products submitted after project award may be rejected and original specified products required. Such conformance will be at no additional cost to Owner.
 - 2. Submit a copy of 3rd party testing and certification documents which prove they meet or exceed the requirements as set forth in this document, for any product or system not specified herein, or proposed as an "equal or better" substitute for Owner-approved products. All products must have independent test data published prior to bid.
- B. Under the provisions of this request for proposal, prior to the start of work the Structured Cabling System Contractor will:
 - 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 manufacturer's data cut sheets for all devices, plates, cable, terminal blocks, patch cords, racks, wire management, labels and similar equipment.
 - 4. Submit any mockup samples for any configured assembly as requested after award of

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contract and before start of work. Example may be a populated and labeled wallplate or WAP cable assembly, denoting jack colors, positions, and proposed labeling scheme.

- C. Work will not proceed without the Owner's approval of the submitted items.

1.08 SHOP DRAWINGS

- A. Provide shop drawings prior to start of work for confirmation of all low voltage systems. Lists of materials is not sufficient; demonstrate usage and connections with schematics, details, and schedules as appropriate.
- B. Provide sufficient details as appropriate to demonstrate subject mastery of installation, connection, programming and commissioning of said systems and receive Owner approval to proceed.
- C. Shop drawings to include:
 - 1. Telecom rooms
 - a. Rack and Telecom Room plans and elevations
 - b. Back board space utilization and layout
 - c. Cable runway placement and routing (to scale)
 - 2. Floor plans
 - a. Wall penetrations
 - b. Cable tray layout, non-contiguous cable pathways (J-Hook) routing, main and side branches
 - 3. Details and schematics
 - a. Adjustments to mounting assemblies and details as needed, or provide new for those not depicted on drawing set
 - b. System schematics and wiring diagrams to show typical connectivity such as:
 - i. Telecom cross-connects, patch panels, and patch cord (patching plan and schedule)
 - ii. One-line diagrams of all Telecom backbone, risers, AV and Security systems
 - iii. Audio-Visual, Security, and Access Control details and connectivity schematics, as appropriate, including all auspices of each or any category, as necessary
 - c. Proposed numbering syntax for panels, room drops and cables.
- D. System Labeling Schedules: Electronic copy of labeling schedules, in editable spreadsheet software format.

1.09 CONTRACTOR QUALIFICATIONS AND TRAINING

- A. The contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data, voice and imaging network systems. The Contractor shall at a minimum possess the following qualifications:

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1. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
 2. Provide references of the type of installation provide in this specification.
 3. Personnel trained and certified in fiber optic cabling, splicing, termination and testing techniques. Personnel must have experience using a light meter and OTDR.
 4. Personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.
 5. Personnel knowledgeable in local, state, province and national codes, and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.
 6. Be in the Low Voltage or Telecommunications Installation business for a minimum of five (5) years. If project is in California, contractor must possess a current California C7 or C10 license. Projects in other states must be supported by the appropriate minimum level contractor's license required for the work involved.
 7. Maintain a certified RCDD on staff and utilize manufacturer trained, Union certified, or BICSI certified Installers for this project.
- B. Contractor Responsibility
1. Preparation of Shop Drawings, Cabling Administration Drawings, and field-testing program under supervision of an RCDD.
 2. Installation Supervision: Installation and field quality control shall be under the direct supervision of BICSI Registered Technician or Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.

1.10 CONTRACTOR WARRANTY

- A. The Contractor shall warranty all installed products, regardless of manufacturer, from the time during installation to a minimum of two years from the day it is turned over to the client, without limitation, other than those stated herein. This warranty shall apply to all equipment malfunctions not caused by abuse or misuse by the Owner or Owner's Representative or its agents.
- B. This warranty shall include all equipment modified by the Contractor, as well as the modifications themselves.
- C. The Contractor shall process all warranty requests during the warranty period.

1.11 MANUFACTURER WARRANTY

- A. A Limited Lifetime Product & Performance Manufacturer's Extended Warranty covering all components (cable, jacks, panels, patch cords, equipment, workmanship, etc.) shall be provided to the Owner, submitted in writing with system documentation. The warranty period shall begin on the system's first use by the owner.

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1. Approved product shall be listed on the most recent version of the applicable Manufacturer's data sheets for each listed solution.
 2. The Contractor must pre-register the project with the Manufacturer before installation has begun. Following project completion, contractor is responsible for completing all warranty registration procedures on behalf of the Owner.
 3. Should the cabling system fail to perform its expected operation within this warranty period due to inferior or faulty material and/or workmanship, the contractor shall promptly make all required corrections without cost to the owner.
- B. Certified Installer shall provide labor, materials, and documentation in accordance with Manufacturer requirements necessary to ensure that the Owner will be furnished with the maximum available Manufacturer's Warranty in force at the time of this project.
- C. The installed structured cabling system shall provide a warranty guaranteeing the specified performance in the installed channel performance above the ANSI/TIA-568 requirements for Category 6, and Augmented Category 6 (CAT 6A) cabling systems or ISO 11801 requirements for Class E and Class E_A, respectively.
1. Standards-compliant channel or permanent link performance tests shall be performed in the field with a Manufacturer-approved certification tester in the appropriate channel or permanent link test configuration.
- D. Necessary documentation for warranty registration shall be provided to the manufacturer by the installer (within 10 days) following 100 percent testing of cables.
1. Installation Contractor shall submit test results to Network Connectivity Manufacturer in the certification tester's original software files.
 2. Installation Contractor shall ensure that the warranty registration is properly submitted, with all required documentation within 10 days of project completion.
 3. Certified Contractor/Integrator must adhere to the terms and conditions of the respective manufacturer's warranty programs.
- E. Manufacturer shall ensure that the Owner receives the project warranty certificate within 60 calendar days of warranty registration completion.

1.12 DELIVERY, STORAGE, AND PROTECTION

- A. Contractor shall ensure that materials delivery to work area shall be coordinated with construction site manager responsible for materials distribution to all trades.
- B. Contractor is responsible for all materials, tools and vehicles left on the job site.
- C. Contractor shall coordinate a disposal bin for the removal of all trash produced by the Contractor's associated personnel during the project.
- D. Contractor shall ensure materials are stored in an environmental area where:
 1. Temperature does not exceed 120 degrees Fahrenheit nor below 32 degrees Fahrenheit.
 2. Humidity does not exceed 80 %.

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3. No direct exposure to sunlight.
- E. 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 will be stored off site at the Contractor's expense.
- F. Deliver equipment in individual shipping splits for ease of handling, mount on shipping skids and wrap for protection.
- G. Inspect and report concealed damage to carrier within specified time.
- H. Store in a clean, dry space. Maintain factory protection or cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation. Meet the requirements and recommendations of NFPA 70B and the Manufacturer. Location will be protected to prevent moisture from entering enclosures and material.
- I. Handle in accordance with NEMA and the Manufacturer's recommendations and instructions to avoid damaging equipment, installed devices and finish.
- J. The equipment will be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the Manufacturer will be required to brace the equipment suitably to ensure that the tilting does not impair the functional integrity of the equipment.

1.13 PROJECT CONDITIONS

- A. Environmental Requirements
 1. Contractor shall ensure that any pollutants produced during the work is disposed of according to local, state or national regulations. Follow the most stringent guidelines.
 2. It is preferred that the Communications Contractor recycle any used or un-used components during the course of the construction project.
 3. Separate and recycle waste materials in accordance with Construction/Demolition Waste Management and Disposal and with the Waste Reduction Work plan.
 4. Avoid using landfill waste disposal procedures when recycling facilities are available.
 5. Place materials defined as hazardous or toxic waste in designated containers.
- B. Field Measurements
 1. Contractor shall coordinate with electrical contractor on project that the main electrical service ground has a resistance to earth of less than 5 ohms.
 2. Contractor shall ensure that all grounding busbars for all equipment network rooms shall have a resistance of less than 1 ohm back to the main electrical service ground.

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3. Contractor shall ensure that all field testers have been calibrated from the Manufacturer within 1 year.

1.14 GENERAL SITE RESTRICTIONS

- A. The Contractor shall effectively protect the Communications spaces, equipment, connecting hardware and materials from dust, dirt and damage during construction.
- B. To mitigate dust containment, Communications spaces shall not be used as storage areas as they tend to accumulate dust particles. This ensures Communications spaces are kept orderly and generally clean.
- C. Precautionary measures shall be taken to ensure that any dust containment measures taken to protect equipment will not cause the equipment to overheat.
- D. Communications spaces, the outside of equipment racks, cabinets and panels, the inside of power panels, connecting hardware, Communications outlets and the like shall be vacuumed daily after the completion of any work in these areas.
- E. Communications room door shall be kept closed at all times for cooling and security reasons.
- F. No food or beverages of any type will be permitted in Communications spaces.

1.15 SEQUENCING

- A. The Contractor shall submit a complete Installation Schedule for the installation of materials and cabling within seven (7) days of being awarded a Work Contract.
- B. The Construction Schedule shall indicate site delivery, installation, and testing dates for conformance to specific task completion dates. As a minimum, the Contractor shall provide the following key milestone dates:
 1. Bid Submission.
 2. Start and Completion of Demolition (if applicable to project).
 3. Completion of Shop Drawing Submission.
 4. Completion of Communications Room Fit-out.
 5. Completion of Horizontal Cabling.
 6. Completion of Labelling.
 7. Completion of Testing.
 8. Completion of As-Built Drawings.
 9. Final Acceptance Review with Consultant or Owner's Representative.
- C. The Contractor shall submit a separate demolition time schedule with applicable cut-over in areas that have existing users. This applies to any areas where operational infrastructure will need to be taken off-line.
- D. Contractor shall coordinate with Owner's project manager on sequencing of various trades

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and construction teams for the lifecycle of the project.

E. Cooperation and coordination with other trades.

1. The work will be so performed that the progress of the entire building construction, including all other trades, will not be delayed and not interfered with. Materials and apparatus will be installed as fast as conditions of the building will permit and must be installed promptly when and as directed.
2. Keep fully informed as to the shape, size and position of all openings required for all apparatus and give information in advance to build openings into the work. Furnish and set in place all sleeves, pockets, supports and incidentals.
3. Coordinate exact locations and roughing in dimensions of all work before installation and make all final connections as required. Any changes required to avoid interferences or to provide adequate clearances for Code and maintenance requirements will be made at no additional costs.
4. Structural elements of the project will not be relocated, altered or changed to accommodate the work without written authorization from the Owner/Architect.
5. Work that is installed before coordination with other trades or that causes interference with the work of other trades will be changed to correct condition at no additional cost to the Owner.
6. Obtain a complete set of Project Drawings and Specifications for coordination and to determine the full scope of work.
7. Attend project coordination meetings to coordinate work of this Section, pathways, work of other trades phasing and other project requirements.

1.16 CONTINUITY OF SERVICE AND SCHEDULING OF WORK

- A. Contractor shall provide a detailed construction schedule with hard dates for completion of roughing in cables, terminations and testing once scheduling sequence has been determined to the Owner's Project Manager.
- B. Cabling schedule shall be in a software program designated by the Owner's Project Manager.
- C. Continuity of all services will be maintained in all areas that will be occupied or temporarily relocated during the construction period. If an interruption of service becomes necessary, such will be scheduled in advance, made only upon consent of the Owner and at a time outside normal working hours as the Owner will designate. The Contractor will schedule the shutdown with seven days in advance. Arrange work to minimize shutdown time.
- D. Should services be inadvertently interrupted, immediately notify the Owner. Be prepared to immediately furnish labor, materials and the equipment necessary for prompt restoration of interrupted service.
- E. Refer to the overall scheduling of the work of the project. Schedule work, process Submittals and order materials and equipment to neither conform to this schedule and install work to not delay nor interfere with the progress of the project.
- F. Inform General Contractor and Architect immediately of any delays or potential delays.

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Furnish Manufacturer's letter to verify order date, equipment delays, expected shipment date, order number, and potential remedies to speed up delivery. Any costs to speed up delivery will be implemented at no cost to the project if the equipment or material was not ordered as soon as possible after Contract award or within the time frames indicated with the Submittals.

- G. Include premium time required to comply with the project scheduling and phasing.
- H. Be aware of, and plan for, project scheduling and phasing. Provide for complete continuous operation of all systems. Coordinate scheduling and phasing with the Architect, Owner, other Trades, and the General Contractor.
- I. Demolition of existing systems being updated will take place only after the new or replacement system is completely installed, operational, tested and certified. This work may be required on a "per-phase" basis.

1.17 PROTECTION OF WORK AND PROPERTY

- A. Be responsible for the care and protection of all work included under this Section until it has been tested and accepted.
- B. Protect all equipment and materials from damage from all causes including theft. All materials and equipment damaged or stolen will be replaced with equal material or equipment at the option of the Architect and Owner.
- C. Materials and equipment stored for this project will be protected and maintained according to the Manufacturer's recommendations and requirements and according to the applicable requirements of NFPA 70B.
- D. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by work or workmen and make good any damage caused.
- E. Use caution to avoid damage to existing work, and to prevent harm to personnel working in all areas.
- F. Observe all safety precautions and requirements for the construction.
- G. The General Contractor and the Installer are responsible for initiating, maintaining, and supervising all safety precautions and requirements during construction.
- H. Coordinate installations with all other trades in order to not damage equipment or cables during construction. Any work that is damaged during construction will not be repaired. Replace damaged work completely, with no splices in cabling, at no additional cost to the Owner.

1.18 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

- A. All conduit and EMT required for Communications cabling pathway in/out of cross connect closets and in/out of wall cavities at the work area. EMT or Conduit for pathways shall have no more than two 90-degree bends between pull boxes and no continuous section over 100'. Combinations which exceed this guideline shall be brought to the attention of the owner prior to finalizing conduit run or installing cable.

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- B. All core holes through concrete, metal, finished hardwood or masonry; in-floor troughs ("Walker Duct"), and poke through devices in the floor for the installation of Communications cabling. Device plates for landing communication cables should be included in the Communications scope.
- C. Back boxes for the mounting of NEMA rated faceplates.
- D. Drag line or pull string at the back boxes fished through existing EMT, conduit, or wall cavities ("Ring and String") to the accessible ceiling or other end of conduit, for installing 4 pair, multi-pair or fiber optic (horizontal and backbone) cables.
- E. Minimum of 2 walls covered in 3/4" AC grade plywood painted white with fire retardant paint in each cross connect closet or connection point for data, voice, video, security and building automation systems. Plywood walls shall be covered 4' W x 8' H whenever possible.
- F. Basket tray or ladder racking to support main pathway cable bundles through hallways, open areas or exiting telecom rooms unless otherwise requested at time of bid.
- G. #2/0 ground wire or other size as appropriate, from Telecommunications Grounding Bus Bar(s) to Building Ground. Use of #6 ground wire, or smaller as allowed, for grounding of telecommunications equipment installed under this Scope is included within the Telecommunications scope of work.
- H. Electrical subcontractors may be required to provide additional lighting, power or grounding connections to the electrical panel, and to provide and install electrical devices as needed. It will be the responsibility of the Contractor to secure all required specialists and subcontractors in order to fully perform under the requirements for these projects.

PART 2 PRODUCTS

2.01 LABELING:

- A. Cables
 - 1. Horizontal and backbone cables shall be labeled at each end according to Owner labeling standards (see below). The cable or its label shall be marked with its identifier.
 - 2. Cable labels shall be machine-generated wrap-around labels with multiple cable ID's printed such that it can be viewable in place without turning the cable.
 - 3. Label cables within 6" of termination point at both ends.
- B. Faceplates
 - 1. A unique location identifier shall be marked on each faceplate to identify its location in the cable plant.
 - 2. Each port in the faceplate shall be labeled with its own unique identifier.
- C. Racks, Panels, Blocks
 - 1. A unique identifier shall be marked on each piece of connecting hardware to identify it as connecting hardware.
 - 2. Each port on the connecting hardware shall be labeled with its own identifier to match

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the other end of the cable.

D. Approved Products:

1. Brother Labelers and P-Touch. TZ Polyester labels.

- a. Use clear tape with black lettering on ivory or stainless steel faceplates (3/8")
- b. Use white (or clear) tape with black letters on white faceplates and surfaces (3/8")
- c. Use black tape with white letters on black surfaces (as appropriate)
- d. Use Flexible ID, white tape with black letters on cables (1"), with several lines of repeating cable ID's for any-angle viewing

PART 3 EXECUTION

3.01 GENERAL

- A. Verify the exact location prior to bid of all items that may be indicated and determine exact location of all electrical items that are not indicated on the Drawings.
- B. Include the cost of all work including sub-letting of any work that may be required to complete the work indicated in order to avoid work stoppages and jurisdictional disputes. The work to be sublet will conform to precedent agreements and decisions of record. Jurisdictional assignment will be a responsibility under this Section's contractual obligation.
- C. Do not install equipment and materials that have not been reviewed by the Architect. Equipment and materials which are installed without the Architect's review or without complying to comments issued with the review will be removed from the project when so instructed by the Architect. No payment will be made for unapproved or removal if it is ordered removed. The Installer will be responsible for any ancillary costs incurred because of its removal and the installation of the correct equipment and materials.
- D. Obtain detailed information on installation requirements from the Manufacturers of all equipment to be furnished, installed or provided. At the start of construction, check all Contract Documents include all Drawings and all Sections of the specifications for equipment requiring electrical connections and service and verify electrical characteristics of equipment prior to roughing.
- E. Equipment and systems will not be installed without first coordinating the location and installation of equipment and systems with the General Contractor and all other Trades.
- F. Any and all material installed or work performed in violation of above requirements will be re-adjusted and corrected by the Installer without charge.
- G. Refer to all Drawings associated with the project, prior to the installation or roughing-in of the electrical outlets, conduit and equipment, to determine the exact location of all outlets.
- H. After installation, equipment will be protected to prevent damage during the construction period. Openings in conduits and boxes will be closed to prevent the entrance of foreign materials.
- I. Home runs indicated are not to be combined or reduced without written consent from the Architect.

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- J. All connections to equipment will be made as required, if applicable, and in accordance with the approved submittal and setting drawings.
- K. Site Observation:
 - 1. Site observation visits will be performed randomly during the project by the Architect. Reports will be generated noting observations. Deficiencies noted on the site visit reports will be corrected. All work will comply with the Contract Documents, applicable Codes, regulations and local Authorities whether or not a particular deficiency has been noted in a site visit report.
 - 2. Be responsible to notify the Architect ten working days prior to closing in work behind walls, raised access floors, ceilings, etc., so that installed work can be observed prior to being concealed.
 - 3. Areas will stay accessible until deficiencies are corrected and accepted. Notify the Architect when all deficiencies are corrected. Return reports with items indicated as corrected prior to re-observation by the Architect.
- L. Change Orders, Modifications, Revisions and Directives:
 - 1. When change orders, modifications, revisions or Architect's Directives are issued or authorized, provide the required additional material, equipment, personnel and workers to prevent delays in the work, and to complete the work within the time limit of the Contract unless a specific time extension is requested with the change and accepted. Include costs for expediting deliveries where required.
 - 2. Requests for additional compensation will be submitted broken down and associated by item, tasks and Drawing or sketch number with material and labor costs, so quantities can be easily verified.
 - 3. Requests will be properly and adequately identified so the scope of work can be clearly determined. Indicate who originated change in work.
 - 4. Submit on all credits broken down as requested for adds. Credits will be separately identified and accounted for. Do not indicate as net changes with adds.
 - 5. Unit costs for labor and material will be equal for adds, deletes and credits.
- M. Loose materials will not be stored on-site. A "gang box" is acceptable to be placed in a location agreeable to the Owner and the General Contractor. The Installer is responsible for all equipment and materials and for their delivery until the system is deemed complete and accepted by the Owner.
- N. A trailer may be used for the storage of materials to be located on the Owner's property at a location designated by the Owner and the General Contractor. Such on-site storage will be kept locked by the Installer. Security for the trailer and its contents will be strictly the responsibility of the Installer.
- O. Protect existing spaces where work is being performed; protect it from damage and from the accumulation of dirt and debris.
- P. Any ceilings, walls, floors, furniture, equipment, furnishings, etc., damaged by the work of this Section will be replaced, or at the Owner's option, repaired with similar materials,

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workmanship and quality.

- Q. Work includes field survey of existing conditions, systems, equipment and tracing of existing circuits in order to determine scope of work.
- R. Maintain the existing building in operation at all times during the entire construction period. If it is necessary to have a system shutdown, a written request for approval will be submitted in advance stating the estimated shutdown time. Work will be planned to minimize shutdown. Shutdowns will be at the convenience of the Owner and, if necessary, on premium time.
- S. Clean and touch up all equipment, materials and work sites at the completion of work in each area.
- T. Certain portions of the work area may be occupied during construction. Determine which areas and schedule work accordingly and include necessary premium time.
- U. Make sure necessary provisions to provide continuous service of all existing systems throughout all occupied areas.

3.02 PRIOR TO INSTALLATION

A. PRE-INSTALLATION CONFERENCE

- 1. Schedule a conference a minimum of five calendar days prior to beginning work of this section.
- 2. Agenda: Clarify questions related to work to be performed, scheduling, coordination, etc.
- 3. Submit shop drawings to Owner for review and approval or comment.
- 4. Attendance: Communications system installer, General Contractor, Owners Representatives and any additional parties affected by work of this section. Owner's Information Technology must be represented at a preconference meeting prior to scheduling of any work.
- 5. Pre-Installation conference may be waived only by Owner.

B. WARRANTY

- 1. A lifetime performance warranty covering all components, equipment and workmanship shall be submitted in writing with system documentation. The warranty period shall begin on the system's first use by the Owner.
- 2. Should the cabling system fail to perform within its expected operation within this warranty period due to inferior or faulty material and/or workmanship, the Contractor shall promptly make all required corrections without cost to Owner.

C. DRAWINGS AND SPECIFICATIONS

- 1. The Contract drawings and specifications form an integral part of the contract documents. Neither the drawings nor the specifications shall be used alone. Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work. Work omitted from the drawings but mentioned or reasonably implied in the specifications, or vice versa, shall be considered as properly and sufficiently specified and shall be provided. Misinterpretation of any requirements on

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drawings, or specifications shall not relieve the Contractor of his or her responsibility of properly completing the Contract.

2. The Owner's Project Manager has the option of changing the location of Electrical and Communication outlets to within 3 meters of designed location prior to rough-in stage at no extra cost to Owner. Owner and Owner's Representative requests a chalk/rough-in walk prior to installation to verify locations.
3. The Contractor is responsible to take field measurements where equipment and material dimensions are dependent upon building dimensions and to coordinate and provide a chalk/rough-in walk prior to installation to verify locations.
4. The Contractor shall coordinate with General, Mechanical and Electrical trades as well as Furniture Layout Designer for final workstation outlet locations.
5. Where conflict exists between drawings and specifications the Contractor shall, make allowance for provision of the component, system, or installation process in a manner which will provide the highest monetary cost components, systems, or installation process. Contractor shall inform the Owner's Project Managers of the conflict and obtain approvals prior taking corrective measures.

3.03 CABLE HANDLING / CABLE MANAGEMENT

- A. Proper cable handling is critical to maintaining the design integrity of high-performance cabling. Cable handling recommendations include:
- B. Cable must be conditioned above 32 degrees F for 48 hours prior to installation.
- C. Do not use excessive force when pulling cable. The maximum pull-force guideline for a 4-pair horizontal UTP should not exceed 110N (25lbf). Meeting this guideline avoids stretching conductors during installation and the associated transmission degradation.
- D. The minimum bend radius for UTP should not exceed 4 times the cable outside diameter (O.D.) The O.D. of Cat 6A 100 ohm, balanced UTP cable is .30 in. ($4 \times .3 = 1.2$ in. bend radius).
- E. The minimum bend radius for fiber should not exceed 10x the cable outside diameter.
- F. Traditional combing and dressing (bundling) of Category 6 and 6A cabling for a combed appearance is required in all exposed locations.
- G. In TR, use appropriate horizontal cable management for patch cords on front of patch panels. Also, use appropriate cable management bar(s) for support of terminated horizontal cable.
- H. Do not use vinyl or plastic cable ties due to the potential for over-cinching of cable bundles which can alter the cable geometry and degrade the system cabling performance. Use only hook and loop ("Velcro") fasteners for bundling of horizontal cables.
- I. Store cable slack in an extended loop configuration to alleviate cable stress. Excessive cable slack in bundled loops or traditional 'service loops' to provide additional cable length in TR has been shown to degrade cabling performance and are not recommended.

3.04 SEPARATION OF DATA AND POWER CABLING

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- A. Design cable pathways to avoid potential sources of EMI. Avoid installing cable near sources of EMI (X-ray equipment, large motors/generators, electrical power cabling and transformers, Radio frequency (RF) sources and transmitters, lighting, copiers, etc.).
- B. Physically separate power & data cabling according to relevant code and standard requirements when run in a common pathway.
 1. Never run data and Class 1 power cabling in parallel closer than 2".
 2. Avoid crossing cables if possible. If necessary, always cross cables at 90 degrees.
 3. Maintain a minimum of 5 in. separation between data cable and all ballast controlled lighting.
- C. Minimum separation distances of telecommunications cabling from potential sources of EMI exceeding 5kVA:
 1. 24" away from Unshielded power lines or electrical equipment in proximity to open or nonmetal pathways
 2. 12" away from Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway
 3. 6" away from Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit pathway
 4. 47" away from Electrical motors and transformers

3.05 INSTALLATION OF STRUCTURED CABLING SYSTEM

- A. PATHWAYS AND TOPOLOGY
 1. Utilize "thin film" lubricants only! It has been shown that cable-pilling lubricants will affect your testing as the cable needs several weeks to dry before attenuation levels recover. Use of incorrect cable lubricants will erode cable jacket and void cable warranty.
 2. All cable and wire shall be concealed in conduits, floor ducts, paneling, ceiling or similar areas except at mutually agreed upon areas.
 3. Fill capacity in conduit, modular furniture and other horizontal pathways should not exceed 40%. A maximum of 60 % pathway fill is allowed to accommodate unplanned additions after initial installation. The Cat 6A cable is a larger O.D. (0.275" – 0.30" vs. .23" for typical for Cat6 cable). The increased diameter of Cat 6A cable will require appropriate design considerations when sizing conduit and other pathways. In most installations, conduit sizes will have to be increased in order to accommodate all of the cables being installed. This will impact the design and material selection of the project. To calculate the fill ratio, divide the sum of the cross-sectional area of all cables, by the most restricted cross-sectional area of the pathway.
 4. Fill ratios for Augmented CAT6 cable (CAT6A) requires 1" EMT for 4 cables and sized larger for additional cables as required to maintain a 60% fill ratio.
 5. Flat-rung and/or solid bottom cable tray shall be utilized for large, high-density installations. J-hooks and other specific cable support hardware shall be used at all

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locations outside of cable tray.

6. Pathway design should not exceed (2) 90-degree bends between pull points or pull boxes (PB). If more than (2) 90-degree bends are required, install a pull box between bends.
7. Provide NEC-sized pullboxes for any run greater than 100 feet, or with more than two ninety-degree bends.
8. J-hooks should be randomly spaced 60" or less. Do not exceed J-hook capacity for size and weight limitations.
9. Land wireless access cabling above ceiling, secured onto in-ceiling bracket. A slack loop in the horizontal cabling is not required. Utilize varying-length patch cords when installing wireless access point devices for flexibility in length.
10. Crimp-on plugs at wireless access points are not allowed. Terminate all WAP cabling onto jacks and ceiling-mount brackets and test all cables as appropriate.
11. Mixing of various Category cables in the same pathway is allowed as long as the applications are appropriate for each category of cable used.
12. Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables. The arrangements to remove any obstructions with the Project Manager need to be determined at that time.
13. Maintain a distance of at least 12 inches from all power conduits and cables. Run communication cables at 90 degrees (not parallel) and 6 inches from all fluorescent lighting fixtures. Do not install power feeders 100 amps or greater above or within 5 feet of telecommunications backboard. Do not install telecommunications conduits above power panels or switchboards.
14. 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.
15. The backbone subsystem shall include cable installed in a vertical manner between floor telecommunications room/closets (TCs or IDFs) and the main or intermediate cross-connect in a multi-story building and cable installed horizontally between telecommunications room/closets and the main or intermediate cross-connect in a long single story building.
16. Unless otherwise recommended by the Owner, all fiber cables will be encased in interlocking armor. All fibers will be terminated in the Telecom Rooms or Cabinets in rack-mounted enclosures equipped with sufficient ports to allow for growth, slack storage space and splice trays if required to terminate and secure all fibers.
17. Adequate riser sleeve/slot space shall be available with the ability to ingress the area at a later date in all Telecommunications rooms/closets, such that no drilling of additional sleeves/slots is necessary. Sleeves may need to be provided and installed under the scope of this Project.

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18. The backbone cables shall be installed in a star topology, emanating from the main cross-connect to each telecommunications room/closet. An intermediate cross-connect may be present between the main cross-connect and the horizontal cross-connect.
19. For voice or data applications, 4 pair UTP or fiber optic cables shall be run using a star topology from the telecommunications room/closet serving that floor to every individual information outlet.
20. Backbone and Horizontal pathways shall be installed or selected such that the minimum bend radius is maintained both during and after installation.
21. All horizontal pathways shall be designed, installed and grounded to meet applicable local and national building and electrical codes.
22. Install $\frac{3}{4}$ " x 4' x 8' fire-rated plywood across all walls in telecom rooms, from 6" AFF to 8'-6" AFF. Coat with 2 coats of white paint. Do not paint over fire rating stamp.
23. Contractor shall firestop all used pathways which enter or leave the telecom rooms via conduit, cable tray or slot. Contractor is responsible for installing sleeves at each wall or partition penetration, and firestopping all fire-rated penetrations. Intumescent caulk shall be applied around the outside of each sleeve, and intumescent putty inside the sleeve or conduits around the cables. Appropriate fill ratios must be followed when penetrating fire-rated walls.
24. Do not run fiber cables in conduits which are less than 2" in diameter.
25. Abandoned cable shall be removed from pathways (i.e., from tunnels, manholes, plenum spaces, and conduit) under scope of this project. Previously unknown or unidentified cable which is apparently abandoned prior to work shall be brought to the attention of the Owner for authorization prior to removal.

B. TERMINAL BLOCKS AND PATCH PANELS:

1. Arrange all terminal blocks in a manner that allows natural wiring progression and minimizes crossing of wires.
2. Dress and comb all incoming cable bundles in groups of 24 cables each. Eliminate crossed cables and "divers".
3. Ground all shielded patch panels to telecom ground source via paint-piercing washers to a grounded rack, or via direct ground wire to telecom bus bar.

3.06 AUDIO-VISUAL DEVICES

A. HDBASE-T DEVICES

1. Follow manufacturer's user's manual for proper installation.
2. One DC 24V power adaptor is required and can be attached at either end as the other can be energized via the PoH function of the interconnecting twisted pair cable.
3. Utilize Category 6A (isolation wrap or shielded) twisted pair cable.
4. Properly secure HDMI cables to devices with lock kit brackets and tie wraps.

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5. Installation methods shall adhere to NFPA National Electrical Code and all local building and fire codes.

B. STANDARD AV EXTENSION DEVICES

1. Follow manufacturer's instruction sheet for proper installation and adjustment.
2. For best performance, Category 6 or 6A twisted pair cable should be installed in accordance with applicable ANSI/TIA-568 standards and be field certified using approved testers.
3. Install DC power adaptor(s) as required.
4. Properly secure all cables with appropriate strain relief methods.
5. Installation methods shall adhere to NFPA National Electrical Code and all local building and fire codes.

C. MIXING AUDIO AMPLIFIERS

1. Follow manufacturer's instruction sheet for proper installation and sound level adjustment.
2. Install DC power adaptor(s) as required.
3. Properly secure all cables with appropriate strain relief methods.
4. Installation methods shall adhere to NFPA National Electrical Code and all local building and fire codes.

D. HDMI CABLES

1. Utilize high-speed Ethernet HDMI cables only.
2. Follow manufacturer's instruction sheet for proper installation
3. Secure HDMI cables to active device ports with cable locking kits or industry best practice to mitigate inadvertent cable disconnects.

E. HDBASET CABLING CHANNELS

1. 100 percent of cabling channels shall be tested to meet or exceed ISO/IEC Class E_A performance parameters.
2. Cabling shall be installed in accordance with manufacturer's recommendations and best industry practices as well as compliance with all applicable sections of this Specification regarding Category-rated structured cabling.
3. When cables are being installed, slack (service loops) shall be provided at both ends to accommodate future changes in the structured cabling system.

3.07 IDF ROOMS

- A. The Data and Telco Rooms are a transition point between the backbone and horizontal distribution pathways. The rooms shall be able to contain data or telecommunications' equipment, cable terminations and associated cross-connection wiring. Closet spaces are

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not to be shared with electrical installations, other than those directly for telecommunications, video, security and information systems equipment. The rooms are not to be shared with other unrelated building service, for example plumbing. Any conflicts with these specifications require the approval of the Owner's project manager.

- B. Contractor shall submit a drawing of the IDF room showing layout of all components including necessary and required electrical outlets, conduits, environmental requirements and wire termination fields prior to start of the job. Any jack densities noted in these specifications are estimates only. The drawing will designate the most effective, scalable, jack termination cabling design to facilitate data/telecom outlets shown on the lease exhibits. Owner's Project Managers must approve drawings prior to installation.
- C. All racks, panels, and equipment finished shall be anchored to meet local seismic zone requirements and industry standards. The equipment racks are to be anchored to the concrete floors via "Unistrut or equal metal framing strut systems", threaded rod, concrete anchors, bolts and washers.
- D. The overhead cable ladder system will provide a route for the Category 6 and 6A, and other communication cables while providing stability to the equipment racks.
- E. The vendor is responsible to provide and install the specified count of 19" EIA rack-mount 7' (45U) 2- post racks, Black, as required in the new IDF. The vendor is responsible for submitting IDF layout drawings to Owner for approval prior to installation.
- F. The contractor shall provide high capacity horizontal and vertical cable manager channels are required in all data and equipment racks, and the racks will contain sufficient vertical and horizontal cable managers to facilitate the patch panel density and placement installed by the contractor.
- G. Contractor will install raceways, boxes, managers, and enclosures as indicated according to manufacturer's written instructions. Securely fasten each component to the surface to which it is mounted and remove burs and sharp edges from all cable tray.
- H. A 12" ladder rack system is required and will be provided by the contractor and installed in the IDF to provide cable support to the rack system. This includes all of the required ladder rack support items such as rack to runway kits, wall angle brackets, ceiling supports, splices (junction and butt), radius drops and j-bolts. The final ladder rack layout will be included in the IDF layout drawing described above.
- I. Provide and install as needed in the IDF room 4' x 8" x 3/4" fire-rated plywood board and labeled with fire rating stamp facing into the room to accommodate rack ladder support, cabling support, grounding platform, data and voice equipment. Paint backboard white (leave stamp visible) to match existing backboard in room, if appropriate. Location of installation is to be determined with approval by Owner.

3.08 GROUNDING

- A. Refer to section 27 05 00 for specifications on Grounding and Bonding.
- B. All grounding (earthing) and bonding shall be done to applicable codes, standards and regulations.

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- C. Shielded cabling channels shall include appropriate method of bonding shield to approved ground for proper EMI/RFI mitigation.
- D. Shield Continuity Testing shall be Enabled when shielded cabling channels are installed.
- E. All shielded and armored cables shall be bonded to a telecom grounding system via shielded patch panels at the rack locations. Shielded Category-rated connectors must be properly installed to maintain electrical ground conductivity along entire length of cable and at both ends of the cable. UTP connectors shall not be used on shielded cables at either end.
- F. Shielded Patch cords shall be provided for use and employed at each workstation location utilizing shielded cable. Shielded patch cords can be identified by their gray color and metallic RJ45 plug. Shielded patch cords are not required at the patch panels.
- G. Telecom Contractor shall bond and ground all telecom room metals. Telecom Contractor shall provide and install TIA-rated Telecommunications Grounding Busbar (TGB) at all MDF and IDF locations, and an in-cabinet grounding busbar at each remote wall-mounted cabinet or telecom enclosure. All ground lugs shall be 2-hole make-up.
- H. Electrician will provide connection between TGB and building ground; Telecom contractor (if separate, otherwise electrician) will provide a busbar and ground all equipment and telecom metals to the busbar.
- I. Telecom installer will ground, and bond all armored and/or shielded cables, racks, cabinets, cable tray, ladder racking, and shielded panels to telecom grounding busbar.

3.09 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping."
- B. Comply with ANSI/TIA-569, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.
- D. Applicator Qualifications: Two years' experience installing UL classified firestopping.
- E. Work, in general, includes furnishing and installing fire and smoke barrier penetration seals for openings in floor, walls, and other elements of construction.
- F. Performance of materials will have been tested to provide fire rating equal to that of the construction.
- G. Environmental Requirements:
 - 1. Furnish adequate ventilation if using solvent.
 - 2. Furnish forced air ventilation during installation if required by Manufacturer.
 - 3. Keep flammable materials away from sparks or flame.
 - 4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
- H. Preparation: Clean surfaces to be in contact with penetration seal materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

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- I. Installation:
 - 1. Install penetration seal materials in accordance with printed instructions of the UL Building Materials Directory and in accordance with Manufacturer's instructions.
 - 2. Seal holes or voids made by penetration to ensure an effective smoke barrier.
 - 3. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.
 - 4. Protect materials from damage on surfaces subject to traffic.
- J. Field Quality Control:
 - 1. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.
 - 2. Keep areas of work accessible until inspection by applicable code authorities.
 - 3. Perform under this section patching and repairing of firestopping caused by cutting or penetration by other trades.
- K. Adjusting and Cleaning:
 - 1. Clean up spills of liquid components.
 - 2. Neatly cut and trim materials as required.
 - 3. Remove equipment, materials and debris, leaving area in undamaged clean condition.

3.10 SEALING OF PENETRATIONS AND OPENINGS

- A. All firestop systems will be installed in accordance with the Manufacturer's recommendations and will be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.
- B. Provide a seal around raceways or cables penetrating full height walls (slab to slab), floors or ventilation or air handling ducts so that the spread of fire or products of combustion will not be substantially increased.
- C. Penetrations through fire-resistant-rated walls, partitions, floors or ceilings will be fire stopped using approved methods and NRTL listed products to maintain the fire resistance rating.
- D. Installation restrictions of the listing agencies will be strictly adhered to {e.g. 24 inch (610 mm) minimum horizontal separation between boxes on opposite sides of the wall, maximum square inch opening in wall}.
- E. Fire stopping in sleeves or in areas having small openings that may require the addition or modification of installed cables or raceways will be soft, pliable, non-hardening fire stop putty. Putty will be water resistant and intumescent.
- F. Fire stopping in locations not likely to require frequent modification will be NRTL listed putty or caulk to meet the required fire resistance rating.
- G. Box penetrations into a fire rated wall or shaft will have a fire-stopping pad installed on the

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back of the box.

- H. Fire stopping of cable trays through walls will be with NRTL listed bags to meet the required fire resistive rating and that will not allow products of combustion to pass through the protected opening. The NRTL listed bags will be installed inside and on both sides of the opening as required to meet the required resistive fire rating of the wall.

3.11 LABELING

- A. Provide machine-generated labels appropriate for all components supplied and installed. Under no circumstances shall handwritten labels be used.
- B. Each faceplate, cable, or data outlet (drop) will be numbered with a unique identifier clearly indicating the voice and data jacks by floor number, station, and outlet identification. This labeling scheme will be independent of any assigned telephone numbers.
- C. The labeling scheme shall not include duplicates of any new or existing cable identification across the entire cable plant.
- D. Labeling procedure will meet TIA-568, TIA-606 (Class 2 Administration) and BICSI Standards.
- E. The labeling scheme will be provided at all locations within the cable infrastructure:
- F. Labeling will be as follows:
 - 1. The numbering scheme will be Floor Number.Outlet Number.Port Number (e.g. Floor 7, faceplate #102, 2nd jack = 7.102.2)
 - 2. Label patch panel RJ-45 jacks numbered sequentially by outlet and port.
 - 3. Label panel by floor number served, if multiple floors are served by one TR.
 - 4. Label Wireless Access Point cabling as AP7.01.1/AP7.01.2 using the same 7th floor example.

3.12 TESTING

A. COPPER TESTING

- 1. Test all equipment and each outlet, horizontal cable, termination block, patch cords, etc. to verify compliance with requirements. Testing shall consist of attenuation and NEXT across all splices and devices installed in the field and shall meet latest requirements of EIA/TIA. Re-terminate any cable or connection found to be defective.
- 2. Tester is to be a Level IV device or better, and configured with the specific cable installed, and the Permanent Link test will be performed according to the Category's standard methodology. All parameters must exhibit a PASS test result prior to project completion. PASS*, FAIL* or FAIL test results will not be accepted.
- 3. Only a permanent link test for Category 6A will be acceptable. If situations demand a "hybrid", "Mixed" or a standard "Channel" design, approval must be obtained for those specific circumstances prior to testing.

B. FIBER OPTIC TESTING

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- Each pre-terminated fiber strand shall be tested for continuity and attenuation with an Optical Power Meter and light source, or OLTS (Optical Loss Test Set) for actual length and splice/connector loss. Each field-terminated fiber strand (if any) shall be tested for attenuation with an Optical Power Meter and light source for splice/connector loss.
- Cable length shall be verified using sheath markings. The guidelines and procedures established for Tier 1 testing in TIA/TSB-140 shall apply.
- All fiber optic cables shall be tested from the site's MDF to each fiber terminals located in the IDF.
- The Contractor shall conduct a bi-directional power meter (loss) test of each fiber optic station and riser cable at both wavelengths, 850/1300nm for MM and 1310/1550nm for SM.
- No individual station or riser fiber link segment (including connectors) shall measure more than 2.0 dB loss for LC, and 1.5dB loss for MTP. LC links shall be tested with LC jumpers from the LC cassette to the tester. MTP links shall be tested either with an MTP tester and array cord, or with an MTP-LC breakout harness and LC duplex fiber tester.
- Tests shall be conducted using ANSI/TIA-526-14A, Method B. Test results evaluation for the panel to panel (backbone) shall be based on the values set forth in ANSI/TIA-568.
- The Contractor shall provide an electronic printout for each strand tested with the OLTS.
- Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between the Owner and the Contractor prior to the start of the test.
- All installed cables must meet or exceed the defined standards for performance. The Contractor shall take all steps and all expense necessary to clean, repair or replace any optic link not meeting the standard.

C. TEST RESULTS

- Repair and resolve any shortcomings in the test results. Mitigation efforts may require re-termination or replacement of the jack, outlet or cable. Repairs or attempts to resolve test failures will be completed solely at the expense of the Contractor.
- Provide test results to Manufacturer and Owner representative in native Tester format. Upon request, provide a copy of the tester software and license, if needed, at no charge to Owner representative.
- Include PDF of full test results, summary index in electronic format on CD or memory stick in the O&M package upon project completion.
- Cabling systems shall meet or exceed the electrical and transmission characteristics of the systems specified.
- Cable segments and links shall be tested from both ends of the cable for each of the construction phases. (Verify that cable labeling matches at both ends).

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6. The system shall not be considered certified until the tester has acknowledged that the performance of the physical layer of the system has been fully tested and is operational at the completion of the installation phase.
7. After the installation is complete, in addition to any other required testing as described herein, and at such times as the Owner/Engineer directs, the Contractor shall be present while the Owner conducts an operating test for approval. The installation shall be demonstrated to be in accordance with the requirements of this specification. Any defects revealed shall be corrected promptly at the Contractor's expense and the tests performed again.
8. After review of the completed test results, the Owner reserves the right to retest cables, utilizing the Contractor's tester and the Contractor's labor.
9. The test results information for each link shall be recorded in the memory of the field tester upon completion of the test. The tester shall be capable of storing test data in either internal or external memory. The external media used shall be left to the discretion of the user.
10. Test results saved by the tester shall be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.
11. Test results shall be provided in both native Tester format as well as comma separated variable (.csv), Portable Document File (.pdf), plain text (.txt), or hypertext markup language (.html/.htm). A copy of the tester native test software must be provided to Owner or Owner's representative for comparison of results.
12. Test Results for CAT3 shall include the following:
 - a. Applicable room number of jack location (room number per Contract Documents)
 - b. Applicable Telecommunications Room number
 - c. Circuit I.D. number with corresponding jack identifier
 - d. Wire Map – shall include the following:
 - i. Continuity to the remote end
 - ii. Shorts between any two or more conductors
 - iii. Crossed pairs
 - iv. Reversed pairs
 - v. Split pairs
 - vi. Any other mis-wiring
13. Test Results for CAT6 shall include all of the above, plus the following:
 - a. Length
 - b. Insertion Loss
 - c. Near-end Crosstalk (NEXT) Loss
 - d. PS-NEXT (Power Sum Near End Cross Talk)
 - e. FEXT (Far End Crosstalk)
 - f. ELFEXT (Equal Level Far End Cross Talk)
 - g. PS-ELFEXT (Power Sum Equal Level Far End Cross Talk)

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- h. Propagation Delay
- i. Delay Skew
- j. Return loss
- k. PSFEXT (Power Sum Far End Crosstalk)
- l. PSACRF (Power Sum Attenuation to Crosstalk Ratio, Far End)

14. Test Results for CAT6A shall include all of the above, plus the following:

- a. AACRF (Alien Attenuation to Crosstalk Ratio, Far End)
- b. AFEXT (Alien Far End Crosstalk)
- c. ANEXT (Alien Near End Crosstalk)
- d. PSANEXT (Power Sum Alien Near End Crosstalk)
- e. PSAACRF (Power Sum Alien Attenuation to Crosstalk Ratio, Far End)

3.13 CLEANING

- A. In all telecom room spaces - a thorough sweeping, vacuuming and wet mopping shall be performed on a weekly basis or more frequently as directed by the owner. Cleaning shall include floors, rafters, floor joists, exposed structural members, exposed mechanical/electrical equipment and ductwork/piping/conduits, walls, ladder trays, tops of cabinets/racks, existing/new passive and active components, or per manufacturer recommendations.
- B. All non-metallic cable managers and snap covers shall be wiped clean, both inside and outside of front, including rear channels. All clear covers and doors shall be cleaned, both front and rear per manufacturer recommendations.
- C. Inside of fiber optic enclosure and patch panels shall be blown clean of settled dust. Cleaning shall be performed for all new construction projects or where gypsum sanding has been performed.
- D. All scraps, boxes, spools, pull-line and trash shall be removed and properly disposed of.
- E. All residual cable lubricant shall be cleaned from floors and walls with an appropriate degreaser.

3.14 PROJECT CLOSEOUT

- A. Operating and maintenance manuals shall be submitted prior to testing of the system. A total of (4) manuals shall be delivered to the Owner. Manuals shall include all service, installation, and programming information.
- B. The Contractor shall submit the following documents to the Consultant or Owner's Representative at the conclusion of the project and within (2) weeks of forwarding notification that Final Acceptance has been achieved.
 - 1. As-Built Drawings
 - a. Provide a USB drive containing a full set of "as-built" (redline) drawings in both modifiable source format (e.g. Word, Excel, AutoCAD, Visio, etc.) and PDF.
 - b. Include (1) hard copy paper format of all as-builts in 17"x22" or 24"x36" size, posted in each telecom room involved in the project. Confirm final size with Owner.

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- c. Provide (1) full size As-Built drawing set in paper form, in hand.
 - d. As-Built drawings shall confirm location and identification of all:
 - i. Communications Outlets and jack numbers with serving communications room ID.
 - ii. Communications rooms.
 - iii. Communications boundary zones.
 - iv. Backbone cable runs.
 - v. Drawings to depict final location and drop/cable identification numbers and labels which match the test reports.
 - e. As-Built drawings shall conform to the most current Drawing Format and Symbols for consistency and must be compatible with Owner computer systems and software.
2. Provide all labelling and administration documentation in a spreadsheet format. A standard sample format will be provided by Consultant or Owner's Representative upon request.
 3. Fire-stop system design and review records documentation.
 4. Provide all cable testing and Warranty Certification test results in native tester format and PDF, on USB medium. PDFs shall contain index tables, individual cable detail records, and plot data.
 5. Provide a spreadsheet of all backbone terminations showing cable number, termination point and room number filled out in the format provided by the Consultant or Owner's Representative.
 6. Provide a spreadsheet of all patch panels and fiber optic splice/termination showing cable number, termination point and room number filled out in the format provided by the Consultant or Owner's Representative.
 7. Provide digital photos of all Communications rooms, system components and major pathways.

C. SUBSTANTIAL COMPLETION

1. The Contractor shall advise the Consultant or Owner's Representative in writing when Substantial Performance has been achieved.
2. Substantial Completion can only be considered after the installation work has been completed, all prior deficiencies noted during previous field review(s) have been completed, As-Built Documentation has been submitted for review, and Manufacturer Warranty Certificates have been applied for and can be verified.

3.15 TRAINING

- A. Provide four (4) hours training on the operation and installation of the data system, at job site, at no cost to owner.

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SECTION 27 01 26 - TEST AND ACCEPTANCE REQUIREMENTS FOR STRUCTURED CABLING

PART 1 GENERAL

1.01 SUMMARY

- A. Principal items of work in this section include but are not limited to:
1. Ensure quality assurance, testing and final acceptance requirements for premises cabling and wireless installations comply with industry standards and Project Construction Documents.
 2. In order to achieve this objective, the guidelines specified below are to serve as a technical reference for the Owner's infrastructure verification and acceptance of the Contractor's testing. The appendix of this section describes specific test procedures that the Owner shall perform during the acceptance testing, particularly those involving LAN, PBX, VTC, and Convergence equipment, and associated cable plants. The procedures provide a comprehensive series of visual, electronic, and optical tests to ensure the infrastructure installation complies with the standards set forth in the specifications. The successful culmination of these tests shall be used to document a physical configuration audit (PCA) as part of the Owner's Quality Assurance (Q/A) Report. Testing shall include physical Q/A review of installation and performance testing of components.
- B. Responsibilities for this specification are as follows:
1. Installer: The Contractor shall follow ANSI/TIA and BICSI installation standards. The Contractor shall perform horizontal cable installation including Category 5e and Category 6 unshielded twisted pair (UTP) cable runs terminated in the communications cabinet and cable terminations at each work area outlet, vertical cable installation, and fiber optic cable runs and terminations. During installation the Contractor shall perform tests as required by the Parent Specification and in compliance with testing standards found in Appendixes B, C, and D of this Section. The Contractor shall notify the Project Inspector 48 hours in advance of any required testing so that the Project Inspector can notify the Owner's Quality Assurance Team to observe the Contractor's test procedures. The Contractor shall forward test documentation to the OAR prior to the Owner's formal acceptance testing.
 2. Contractor's Site Responsibilities during formal Owner's Quality Assurance: During formal Owner's Quality Assurance, the Contractor and his/her Subcontractor shall comply with testing standards and requirements detailed in Appendixes A through F. Under the guidance of the Project Inspector and in coordination with the Owner's Quality Assurance Team, the Installer shall:
 - a. Verify LAN connectivity and WAN extension cabling to MDF.
 - b. Configure the router(s) and switch(es) in compliance with the Contract Documents.
 - c. Aid the Owner's Quality Assurance Team with network cut over. (For example: existing systems with internet connectivity and administration systems including but not limited to SIS and payroll).
 - d. Provide labor, materials, and testing equipment (For example: Power Meter, OTDR) to correct any deficiencies with labeling, cable charts, terminations, and Installer supplied test results.
 - e. Provide keys and access to installed network equipment.

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3. Owner's Quality Assurance Team Responsibilities: Using the procedures specified in the Appendixes of this guideline, the Owner's Quality Assurance Team shall verify that the infrastructure installed under the Contract complies with the installation standards detailed in the Specifications. Specifically, testing shall be performed by the Owner on vertical and horizontal cable, (For example: fiber optic, Category 5e UTP and Category 6 UTP) along with component installations performed under the scope of the overall infrastructure effort (For example: Ethernet switches and routers). Generally, testing specifications and procedures cover the following:
 - a. Q/A review of equipment rack installation; including placement in the communications cabinets, attachment to the floor, and seismic bracing.
 - b. Q/A review of fiber terminations, patch panel installation, cable labeling, and cable bundling.
 - c. Q/A review of Category 5e and Category 6, T568B terminations, including cable end connections at the patch panel and work area outlets.
 - d. Q/A review of the Contractor's Redlines for accuracy.
 - e. Industry standard for fiber optic, Category 5e and Category 6 cable performance testing.
 - f. Network equipment performance verification.
 - g. Uninterruptible power supply performance verification.
 - h. Communications cabinet layout and facility drop count verification.

C. Acronyms:

dB	Decibel
IDF	Intermediate Distribution Facility
ITD	Information Technology Division
LAN	Local Area Network
LDC	Local Distribution - Classroom
LDF	Local Distribution Facility
MDF	Main Distribution Facility
MPOE	MainPoint of Entry
NVP	Nominal Velocity of Propagation
OAR	Owner Authorized Representative
PA	Public Address
PBX	Private Branch Exchange
QA	Quality Assurance
UTP	Unshielded Twisted Pair
VoIP	Voice over Internet Protocol
WLAN	Wireless Local Area Network

1.02 CODES AND STANDARDS

- A. ANSI/TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises.

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- B. ANSI/TIA-568-C.1 Commercial Building Telecommunications Cabling Standard, current issue.
- C. ANSI/TIA-568-C.2 Balance Twisted-Pair Telecommunications Cabling and Components Standards.
- D. ANSI/TIA-568-C.3 Optical Fiber Cabling Components Standards.
- E. ANSI/TIA-1152 Requirements for Field Test Instruments and Measurements for Balanced Twisted Pair Cabling.
- F. EIA/TIA-569-B, Commercial Building Standard for Telecommunications Pathways and Spaces and all current addenda.
- G. ANSI/EIA/TIA-598-A, Optical Fiber Cable Color Coding, current issue
- H. EIA/TIA-606A, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
- I. ANSI-J-STD-607-A Commercial Building Grounding and Bonding Requirements for Telecommunications.
- J. EIA/TIA-OFSTP-14A, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.
- K. ANSI/TIA/EIA-758, Customer-Owned Outside Plant Telecommunications Cabling Standard, current issue in accordance with TIA TR-42.4.
- L. EIA/TIA-OFSTP-7, Optical Power Loss Measurements of Installed Single mode Fiber Cable Plant.
- M. American National Standards Institute (ANSI)/EIA/TIA-455-59, Field Testing.
- N. FCC Part 68.
- O. National Electrical Manufacturer's Association (NEMA).
- P. National Fire Protection Association (NFPA), NFPA-70.
- Q. CCR Part 3 - California Electrical Code (CEC).
- R. CCR Part 2 - Uniform Building Code (UBC).
- S. Building Industry Consulting Services International (BICSI) TDMM, most recent revision.
- T. Institute of Electrical and Electronic Engineers (IEEE).
- U. Other Codes and Standards as defined in the Parent Specification.
- V. Fluke Networks DTX Series Cable Analyzer Technical Reference Handbook 01/11 or newer.

1.03 Punch List

- A. Per OAR request, The Owner's Quality Assurance Team shall assist in the Punch List for IT and low voltage systems and provide it to the OAR.

1.04 Quality Assurance

- A. Owner's Quality Assurance Test Schedule:
 - 1. The Project Inspector shall schedule the Owner's Quality Assurance test after review of the Contractor's complete Test Results of the school.

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PART 2 MATERIALS - NOT USED

PART 3 EXECUTION

3.01 Equipment Installation

- A. The Installer is responsible for basic installation and cross connection of LAN equipment required by the Contract Documents.
- B. The Owner's Quality Assurance Team shall verify that basic installation is complete and functional.

1.

END OF SECTION

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SECTION 27 10 15 - PREMISES WIRING FOR CONVERGENCE OF COMMUNICATION SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. This specification includes equipment provisioning, installation, integration, configuration, testing, and documentation of wiring/cabling and associated pathways for Local Area Networks, Signal Terminal Cabinets and Telephone systems at the Peralta District (OWNER). This specification uses 50 micron multi-mode fiber and Category 5e/6/6a UTP cable and shall be used for new cable plant construction, when completely replacing an existing cable plant or for modernization of cable plant where 50 micron multi-mode optical fiber is required and Category 5e/6/6a UTP was previously installed. Pertinent sections are broken down to reflect the requirements for each system individually.

1.02 CODES AND STANDARDS

- A. Underwriters Laboratories Inc. (UL): Applicable listings and ratings.
- B. UL 50, Cabinets and Boxes
- C. UL 943, GFCI.
- D. UL 489, Molded Case Circuit Breakers.
- E. National Electric Code, Article 384
- F. National Electric Code (Articles 770, 800, latest issue).
- G. National, State, and Local Occupational Safety and Health Administration (OSHA) building and fire codes.
- H. NEMA PB1.
- I. Federal Specifications W-P- 115C and WC-375B.
- J. ANSI/TIA/EIA Telecommunications Building Wiring Standards.
- K. ANSI/TIA/EIA-568: Commercial building telecommunications wiring standard and all current addenda.
- L. ANSI/TIA/EIA-568-B.1 Annex A, Centralized Optical Cabling
- M. ANSI/TIA/EIA-569, Commercial Building Standard for Telecommunications Pathways and Spaces, current issue
- N. ANSI/TIA/EIA-569-A-1, Commercial Building Standard for Telecommunications Pathways and Spaces Addendum 1 - Surface Raceways (March 2000).
- O. ANSI/EIA/TIA-598-A, Optical Fiber Cable Color Coding, current issue
- P. ANSI/TIA/EIA-606, The Administration Standard for the Telecommunications Infrastructure of Commercial Building, current issue
- Q. ANSI/TIA/EIA-607, Telecommunication Bonding and Grounding
- R. ANSI/TIA/EIA-758, Customer-Owned Outside Plant Telecommunications Cabling Standard, current issue
- S. Institute of Electrical and Electronic Engineers (IEEE) 802.3 (Ethernet), 802.3Z (Gigabit Ethernet over optical fiber), 802.3ab (Gigabit Ethernet over 4 pair category 5 or higher), 802.11 (Wireless LAN).

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- T. BICSI Telecommunications Distribution Methods Manual
- U. Federal Communication Commission (FCC) Part 68.50.
- V. National Electrical Manufacturer's Association (NEMA).
- W. National Fire Protection Association (NFPA), NFPA-70.
- X. CCR Part 3 - California Electrical Code.
- Y. CCR Part 2 - Uniform Building Code.

1.03 SUBMITTALS

- A. List of Materials: Submit a complete list of proposed materials. As a minimum include the following information: catalog cuts, product technical data and descriptive literature of all components. Data shall be clearly marked and noted to identify specific ranges, model numbers, sizes, and other pertinent data necessary for evaluation and acceptance.
- B. Shop Drawings: Provide detailed and dimensioned Shop Drawings indicating kind, weight and thickness of materials, equipment locations, wiring and schematics, details, panel configurations, sizes and a point-to-point wiring diagram of all circuits, method of fitting and fastening parts together. Drawings shall contain sufficient information to assemble and install equipment at the Project site without further instructions.
 - 1. Shop drawings shall indicate interfaces to equipment furnished by others, identifying numbers of wires, termination requirements, and other pertinent details. Responsibility for each end of interfaces shall be noted on shop drawings.
 - 2. Shop Drawings shall include a front elevation indicating cabinet dimensions, make, location and capacity of equipment, size of gutters, type of mounting, finish, and catalog number of locks. Provide general layout of internal devices, wiring drawings with wire numbers and device connections, cut sheets of devices in enclosure and bill of materials listing description, manufacturer, part numbers, and quantity of items.
- C. Each submittal shall be bound and shall contain an index organized vertically by assembly and item number and horizontally by columns. The first assembly shall be the major head end equipment. The leftmost column shall be the item number; next shall be the description, followed by the applicable specification section number, and followed by the specified item, which is followed by the submitted item. The rightmost column shall be for notes, which shall be used to reference the reason for submitting items other than as specified.
- D. Each submittal shall contain product data sheets or catalog cut sheets for each item listed in the Index. These shall be arranged in the same order as the index and if more than one item is shown, the submitted items shall be highlighted or marked with an arrow. The product data shall be sufficiently detailed to allow the engineer to evaluate the suitability of the product and to allow other trades to provide necessary coordination.
- E. CONTRACTOR shall provide Shop Drawings, in the same size as the Drawings, prepared and signed by a BICSI Registered Communications Distribution Designer (RCDD). Shop Drawings shall be prepared in latest version of AutoCAD or Microsoft Visio with 3 USB flash drive electronic copies submitted along with full sized Shop Drawings.
- F. Submit Shop Drawings prepared, signed, and sealed by structural engineer licensed in the State of California. Details shall be provided indicating the proposed means of support and attachment of all wall and floor mounted racks. Calculations shall be based on the maximum load rating of the cabinet by the manufacturer in a Zone 4 seismic environment, not the weight at time of occupancy. MPOE racks or cabinets shall support a minimum of 750 pounds of static weight. IDF racks or cabinets shall support a minimum of 250 pounds of static weight. Classroom wall-

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mounted racks or cabinets shall support a minimum of 125 pounds of static weight. If applicable, the CONTRACTOR shall provide a Network Protection Plan that defines how an existing school or campus Local Area Network (LAN) will remain in service during the installation of either new LAN cabling or additional LAN cabling segments in a manner that ensures the installation shall not interfere with or disable any portion of existing, working LANs during the project. This plan should be prepared by the CONTRACTOR and approved by the ARCHITECT prior to the start of work.

- G. Samples: CONTRACTOR shall provide samples of material and equipment as required by the ARCHITECT. If Samples are requested, they shall be submitted within 10 days from date of request.
- H. Submit one (1) electronic and one (1) paper copy of all cable records. Refer to Attachment 1 for format of required cable records.

1.04 SUBSTITUTIONS

- A. Equipment, Material or components that deviate from these requirements shall not be accepted without written approval from OWNER'S Information Technology Department authorized representative. When proposing deviations, the following shall be submitted:
 - 1. Substitution request form indicating reasons and benefits to OWNER.
 - 2. OWNER'S approval shall be obtained.
- B. Substitutions: Submittals must comply with contract general provisions.

1.05 QUALITY ASSURANCE

- A. The CONTRACTOR shall use adequate numbers of skilled personnel who are manufacturer certified, thoroughly trained and experienced on the necessary crafts and completely familiar with the specified requirements and methods needed for the proper performance of the work.
- B. The work of this section shall conform to California Code of Regulations, Part 3, and all other applicable codes and standards.
- C. Permits and Inspections: Obtain and pay for required permits and inspections; deliver certificates of inspection to the IOR.
- D. The work shall be performed by a qualified CONTRACTOR holding the licenses required by legally constituted authorities having jurisdiction over the work.
 - 1. CONTRACTOR shall have completed at least five (5) projects of equal scope to systems described herein and shall have been in the business of supplying and installing specified type of systems for at least five (5) years.
 - 2. CONTRACTOR shall include in the Product Data list submission, copies of current manufacturer certificates indicating that the CONTRACTOR is an authorized distributor of the manufacturer products, has been trained in the installation of those products, and has a service organization capable of responding within 24 hours of receipt of written notification and resolution within 1 day for MPOE equipment and 5 days for equipment located either in the classrooms, or IDFs
 - a. Material or work damaged during the planning, installation, testing, and clean-up of this project must be replaced or repaired, at no expense to the OWNER, to meet current OWNER specifications before final acceptance of work. Examination of or failure to examine work by the OWNER shall not relieve CONTRACTOR from these obligations.
 - b. Installation shall be performed in accordance with applicable building codes, industry standards, and best trade practices.

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- c. CONTRACTOR shall include in the Material List Submission copies of the manufacturers' certifications that the CONTRACTOR is a current authorized distributor of the submitted manufacturers' products and CONTRACTOR's staff has been adequately trained and certified in the installation of those products. This requirement applies to all structured cable components and cable described in this specification.
- d. CONTRACTOR shall coordinate cable runs, and rack equipment locations with the OWNER's Authorized Representative prior to start of construction. CONTRACTOR and OWNER's Authorized Representative must agree as to the final location of all devices and the cable plant design.

1.06 WARRANTY

- A. CONTRACTOR shall warranty that all materials furnished shall be free from defects of material for a period of five (5) years excluding specific items of work that require a warranty of a greater period that may be set forth in this Specification. CONTRACTOR shall warranty that workmanship for a period of five (5) years from Substantial Completion, excluding specific items of work that require a warranty of a greater period that may be set forth in this Specification. Immediately upon receipt of written notice from the OWNER, the CONTRACTOR shall repair or replace at no expense to the OWNER, any defective material or work that may be discovered before final acceptance of work or within the warranty period; any material or work damaged thereby; and adjacent material or work that may be displaced in repair or replacement. Examination of or failure to examine work by the OWNER shall not relieve CONTRACTOR from these obligations.
- B. CONTRACTOR shall provide a performance warranty for the installed data cabling system and components for a minimum of fifteen years after system is turned over to the OWNER. All components of the optical data backbone cable system including cables, distribution shelves, LIUs and connectors must carry a fifteen-year single manufacturer's applications warranty at speeds of 1 or 10 Gbps.

1.07 SYSTEMS REQUIREMENTS

- A. The premises wiring shall comply with the following system requirements:
 - 1. Local Area Network Wiring: The CONTRACTOR shall furnish all labor, supervision, tooling, miscellaneous mounting hardware, materials and consumables, including patch cables for all systems installed; in addition, the CONTRACTOR shall provide construction and integration services to achieve connectivity for all classrooms, computer laboratories, libraries, instructional areas, offices, and work areas, as specified by the OWNER point of contact.
 - a. New segments, installations, modifications, shall not interfere with or disable any portion of existing, working LANs.
 - b. Conduct underground survey to ensure constructability of all outside plant pathway routing.
 - c. Provide exterior and interior optical fiber and copper cabling that is in compliance with TIA/EIA 568-B standards. Cabling system colors shall be coordinated using consistent colors for the same type of cabling as indicated elsewhere in this specification.
 - d. Install and connect rack mounted uninterruptible power supplies and Ethernet switches in all equipment cabinets at locations with active equipment. IDFs are exempt from the UPS requirement.
 - e. Furnish and install cabinets/racks, vertical power strips, cable trays and cable management at the IDF.

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CABLE DESIGNATION	
TYPE	DESCRIPTION
A	Service entrance cables installed by the service provider.
B	Interior grade, multi-pair PVC jacketed cables to be terminated on 110-type blocks.
C	Interior PVC multi-pair cables, or exterior shielded cables for installation on buried conduits. These cables connect to patch panel(s) either by means of anphenol connector or punch down connector.
D	Category 5e/6/6a cables terminated on patch panel on one end and on an RJ-45 wall jack insert on the other end.

- f. Furnish and install modular T-568-B patch panels for termination of UTP within the IDF, and where copper drops are provisioned. Use fiber patch cabinets for all fiber optic cable terminations located in the IDF room.
- g. Furnish and install connectors and faceplates and terminate cables as specified.
- h. Furnish and install all high impact plastic wall and/or faceplate covers and connector housings for all communication systems outlet locations
- i. Furnish and install contiguous optical fiber and copper, link and distribution cables. No splices are permitted between designated termination points.
- j. Furnish and install floor mounted equipment racks, with zone 4-rated seismic bracing and associated accessories in telecommunications spaces where required
- k. Furnish and install grounding and bonding of all communications components per ANSI/TIA/EIA-607.
 - 1) All Telecommunication Entrance Facilities, Minimum Point of Entry locations shall be equipped with a telecommunications main grounding busbar or telecommunications grounding busbar as appropriate to the installation environment.
 - 2) Grounding Equalizers or Telecommunications Bonding Backbone Interconnecting Bonding Conductors are not required except in buildings exceeding two occupied stories which use building steel to ground electrical service panels.
 - 3) In buildings with two stories or less, where electrical panels are grounded using CEC compliant grounding conductors directly connected to the building ground electrode, all IDF equipment chassis and associated peripherals shall use local panel ground via the equipment branch circuit grounding conductor.
- l. Furnish and install full labeling of the entire installation prior to testing in accordance with Part 3.04 paragraph C of this specification.
- m. All Premise cable shall be tested in compliance with Specification 27 0126. Testing of each LAN optical fiber element and connector with Power Meters and OTDR. For multi-pair copper communications cable, test all pairs within counts and binder groups to ensure that no less than 99% of the pairs of a multi-pair cable achieve continuity and operation in voice band tests. For Category 5e/6/6a copper cable, test and certify 100% of all drops using test equipment certified for Level III test equipment. Cable designations:

- B. Telephone Systems Wiring: The telephone wiring system consists of distribution and feeder cables that permit connection of telephone handsets or other interfacing devices, through cross connecting panels, back to connecting blocks associated with an OWNER-furnished, OWNER installed PBX System. The installation of the PBX system and related powering systems is outside the scope of this specification.

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1. The quantity of Telephone System cabling shall be designed based upon the size and scope of the project, or in accordance with drawings furnished by a designer. Telephone cables installed between the Minimum Point of Entry (MPOE) or PBX system location and respective Intermediate Distribution Frames shall be the sum of current telephone requirements plus a 40% growth factor of spare cable pairs.
 2. Equipment specifications for the Project site shall be as indicated on Drawings, the scope of work, and/or as specified herein.
 3. Install and connect OWNER furnished telecommunications equipment cabinet, attendant consoles, and telephone instruments as indicated on Drawings or Scope of Work.
 4. Furnish, install, and connect ground wire, and power supplies as specified and/or required. Coordinate provision of dedicated power outlets.
 5. Furnish and install connecting wiring and modular jacks to each individual phone location as indicated on Drawings. This includes all necessary cross connect blocks, and cross connect wiring in cabinets/racks, as necessary to provide for functions and requirements specified. All cables shall be installed in conduits, cable trays or raceways unless indicated otherwise on Drawings. Cabling system colors shall be coordinated using consistent colors for the same type of cabling as described in section 2.04 of this specification.
 6. Provide and install pathway and inside cabling from the IDF to the Minimum Point of Entry (MPOE) and install pathways from MPOE to the property-line Public Switch Telephone Network demarcation.
 7. Provide infrastructure and facilities for interfacing the site's telecommunications infrastructure with public utilities telephone lines at the MPOE. Provide underground telephone service conduit from public utility serving location to main telephone terminal as indicated on Drawings and in compliance with requirements of access provider.
 8. Provide and coordinate the location of surge-protected outlets in all equipment cabinets and enclosures where active equipment is scheduled.
 9. Furnish and install 110 type telephone punch blocks at PBX location using multi-pair cable for interconnection to the MPOE and IDFs, as required.
 10. Provide coordination, testing, materials, and components required for a complete and operational installation.
- C. Signal Terminal Cabinets: Signal terminal cabinets shall meet the following:
1. Terminal cabinets shall be flush type, with 2-inch trim or surface mounted type, or as otherwise indicated on Drawings. Terminal cabinets shall be furnished with sections and barriers to separate each system. Sections over 24 inches in width shall be provided with double doors and locks. Terminal cabinets shall measure 12 inches long x 18 inches high x 5-3/4 inches deep, unless otherwise indicated on Drawings. Trims for sectional cabinets shall be of one-piece construction.
 2. Terminal cabinets shall be furnished with 3/4-inch thick plywood backboards within cabinets, fastened in place with machine screws. Backboards shall be largest size cabinet and conduit terminations will permit.
 3. Flush-mounted terminal cabinets shall be finished as specified for flush-mounted panelboard cabinets. Surface and semi-flush mounted terminal cabinets shall be finished as specified for surface-mounted panelboard cabinets.
 4. Terminal Cabinets for exterior Ethernet drop locations shall be NEMA Type 3R continuous hinge cover enclosure with a padlock draw pull catch or cylinder lock on the opposite side.

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The enclosure and cover shall be built of 16-gauge galvanized steel and shall carry an IEC IP32 rating. The enclosure shall be large enough to fit a weatherproof single gang deep box and an industrial type Category 5e/6/6a patch cord 10 feet long as described in section 2.02.N. of this specification. CONTRACTOR shall provide a padlock or cylinder lock keyed to Corbin CAT 90 for each enclosure.

5. Signal terminal cabinets shall conform to the Specifications in section 26 2416, except as modified herein.
 6. Terminal cabinets shall be flush or surface type with 2-inch trim or surface mounted type, as indicated on Drawings. Terminal cabinets shall be provided in sufficient quantity to allow no more than one signal system per cabinet. Terminal cabinets shall measure a minimum of 12 inches wide x 18 inches high x 5-3/4 inches deep, unless otherwise indicated on Drawings. Trims for sectional cabinets shall be of one-piece construction.
 7. Cabinet Boxes shall be fabricated of galvanized steel compliant with NEMA 250; unless otherwise noted. Boxes shall be flush or surface type with removable end-walls, and dimensioned as indicated on Drawings. Provide 3/4-in.-thick plywood backboard fastened in place with machine screws and painted matte white with fireproof paint for mounting terminal blocks. Backboards shall be largest size cabinet and conduit terminations will permit.
 8. Cabinet Fronts shall be fabricated of steel compliant with NEMA 250, unless otherwise noted. Fronts shall be flush or surface type as indicated on Drawings; with screw cover front and gray baked enamel finish. Doors shall be cut true, and shall accurately fit opening and finish smoothly across joints. Rabbets shall be inside. Hinges shall be entirely concealed except for barrels and pins. Hinge flanges shall be welded to door and trim. Doors shall be equipped with flush type, spring-latching, Corbin locks for metal doors, keyed to Corbin No. 90 keys.
 9. Provide protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.
 10. Terminal Cabinets shall be located so they are readily accessible and not exposed to physical damage.
 11. Cabinet locations shall provide sufficient working space around panels to comply with the California Electrical Code and the BICSI TDDMM.
 12. Terminal Cabinets shall be securely fastened to the mounting surface by at least 4 points.
 13. Unused openings in cabinets shall be effectively closed.
 14. Cabinets shall be grounded as specified in Article 250 of the California Electrical Code.
 15. Conduits shall be installed so as to prevent moisture or water from entering and accumulating within the enclosure.
 16. Maintain the required bending radius of cable and conductors inside the cabinet.
 17. Clean the cabinets of foreign material such as cement, plaster, metal filing, and paint.
 18. Remove debris from terminal cabinet interior.
- D. Underground service entrances are required for connections to:
1. Telephone Service Provider.
 2. Community Antenna Television (CATV) Access Provider.

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PART 2 PRODUCTS

2.01 MATERIALS AND FABRICATION

- A. Where applicable all components installed under this Contract shall be listed by UL or other Nationally Recognized Testing Laboratory (NRTL).
- B. Equipment Requirements.
 1. Various manufacturers' equipment may meet the standards of quality set by the OWNER. As a reference and for comparison of vendors, the equipment specification sheets on all items must be included with the submitted bid.
 2. The OWNERs Quality Control representative or designated agent will establish equivalency and compliance of product or components offered for use under this Contract.

2.02 LOCAL AREA NETWORK CABLING

- A. Multi-mode Optical Fiber Cables.
 1. The optical fiber shall be multimode, graded-index optical fiber waveguide with nominal 50/125-micron core/cladding diameters. The optical fiber shall comply with ANSI/EIA/TIA-492AAAC.
 2. The mechanical and environmental specifications for multi-mode fiber distribution cables shall be indoor/outdoor, riser rated, tight-buffered type cables. The cable shall meet the requirements of the California Electrical Code (CEC) section 770 and the requirements of TIA-455-82B water ingress test. The CONTRACTOR shall confirm that the cable is listed for the specified application.
 3. Each cabled optical fiber shall meet the graded-index attenuation performance specifications of ANSI/TIA/EIA 568-B including current sub sections and addendum. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-46, -53, or -61. Information transmission capacity shall be measured in accordance with ANSI/EIA/TIA-455-51 or -30. The cable shall be measured at 23 °C ± 5 °C.
 4. Multi-mode fiber optic cable shall meet the following minimum performance requirements:
 - a. Attenuation: The maximum attenuation of the multi-mode OM4 fiber shall be 3.5db/km or less at 850nm and 1.5db/km or less at 1300nm.
 - b. Utilize OM4 50/125 multi-mode fiber to meet or exceed standard bandwidth and distance limitations. Cable manufacturer shall guarantee that the multi-mode optical cable will support 802.3z 1000BASE-SX Ethernet transmission up to 1000 meters and 802.3ae 10GBASE-SR Ethernet transmission up to 500 meters using VCSEL based SX optics.
 - c. At 850 nanometers (nm), the minimum bandwidth capability required is 4700 MHz-Kilometer. Actual bandwidth will vary by cable manufacturer.
 - d. 1300nm, the minimum bandwidth capability required is 500 MHz-Kilometer.
- B. Single-Mode Fiber Cables.
 1. Single-mode optical fibers shall be Class IVa Dispersion-Unshifted Single-mode Optical Fibers and shall comply with ANSI/EIA/TIA-492CAAB. Fiber conductors shall have a nominal core diameter of 8.7 microns. Cable shall have transmission window centered at 1310 and 1550 nanometer wavelengths.
 2. The mechanical and environmental specifications for single-mode fiber distribution cables shall be indoor/outdoor, riser rated, tight-buffered type cables. The cable shall meet the

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requirements of the National Electrical Code (NEC) section 770 and the requirements of TIA-455-82B water ingress test. The CONTRACTOR shall confirm the cable is listed for the specified application

3. Each cabled optical fiber shall meet the attenuation performance specifications of ANSI/TIA/EIA 568. Attenuation shall be measured in accordance with ANSI/EIA/TIA – 455-78A or –61. The cable shall be measured at 23 °C ± 5 °C.
- C. Fiber Optic Connectors. All fiber optic connectors shall be Duplex LC type, MM or SM connector.
 - D. Fiber Optic Light Interconnection Units (LIUs). Rack mounted with the capacity to handle a minimum of 18 terminated fibers. Complete kit to include all panels' bulkheads and supporting hardware.
 - E. Fiber Optic Distribution Shelves. 72 port rack mountable, with LC-compatible bulkheads and built-in cable management.
 - F. Fiber Optic Jumper Cables.
 1. Multi-mode or Single-mode duplex cable. Length: 3 meters, at a minimum, pre-manufactured with LC-LC connectors with same transmission characteristics as the terminated fibers as defined in section 2.02.
 2. Fiber optic patch cables shall be supplied in sufficient quantity to connect each active fiber pair at intermediate cross-connect locations identified in the construction documents. Patch cables are not required for spare fibers. Intermediate cross-connect locations include the following:
 - a. Cross connect between the IDF and MPOE.
 - b. IDF – cross connect between primary backbone and secondary backbone or horizontal fiber.
 3. Fiber optic patch cables shall be OFN type, jacketed with polyvinyl chloride with yellow indicating a single-mode patch cable and aqua indicating a 50/125 multi-mode patch cable. The cable shall meet all requirements of TIA/EIA-568 except for the more stringent requirements on bandwidth and attenuation identified in this Specification.
 - G. Fiber Optic Innerduct. Materials: one-inch and/or one and one half inch, orange corrugated with pullrope, rated as required by code.
 - H. Category 5e/6/6a data Cable. Horizontal Category 5e/6/6a cabling shall be 24 AWG, 4-pair UTP, UL/NEC rated, with appropriately rated PVC (riser) or FEP (plenum) jacket as appropriate to the installation environment and N.E.C. Individual conductors shall be FEP or polyethylene insulated as appropriate to the installation environment. Cables installed in cable trays or on "J"-hooks shall carry a CMP rating regardless of the installation environment. Cable shall meet ANSI/TIA/EIA minimum requirements for return loss, propagation delay, delay skew, NEXT loss, PSNEXT loss, FEXT loss, ELFEXT, and PSELFEXT for 4-pair Category 5e/6/6a cabling as detailed in ANSI/TIA/EIA-568. Category 5e/6/6a data cabling and patch cables shall be yellow or green.
 - I. Flooded Category 5e/6/6a cable for all underground applications or ground level in-slab environments: Category 5e/6/6a cabling shall be 24 AWG, 4-pair UTP, UL/NEC rated, with appropriately rated polyethylene jacket with water blocking flooded core. Individual conductors shall be polyethylene insulated. Cable shall meet ANSI/TIA/EIA minimum requirements for return loss, propagation delay, delay skew, NEXT loss, PSNEXT loss, FEXT loss, ELFEXT, and PSELFEXT for 4-pair Category 5e/6/6a cabling as detailed in ANSI/TIA/EIA-568.
 - J. Category 5e/6/6a Inserts. All Category 5e/6/6a data inserts shall be wired to the T568B wiring pattern. Category 5e/6/6a data inserts shall meet ANSI/TIA/EIA minimum requirements for return loss, propagation delay, delay skew, NEXT loss, PSNEXT loss, FEXT loss, ELFEXT, and

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PSELFEXT for Category 5e/6/6a connecting hardware as detailed in ANSI/TIA/EIA-568. Category 5e/6/6a data inserts shall be yellow or green in color as consistent with the cable jackets for this system

- K. Exterior Category 5e/6/6a data drops shall be embedded in an environmentally sealed enclosure with an IEC IP67 rating for Protection from live or moving parts, dust and protection from immersion in water and with ADC 110 punchdown contacts for field termination of horizontal backbone cable of specified length. The connector shall combine existing RJ-45 connector technology with weatherproof housing assemblies and shall be compatible with standard Category 5e/6/6a RJ-45 connectors. The exterior Category 5e/6/6a connector shall interlock with exterior patch cord as described in Section 2.02.N of this Specification, and provide a seal with an IP67 rating. All Category 5e/6/6a data inserts shall be wired to the T568B wiring pattern. Category 5e/6/6a data inserts shall meet ANSI/TIA/EIA minimum requirements for return loss, propagation delay, delay skew, NEXT loss, PSNEXT loss, FEXT loss, ELFEXT, and PSELFEXT for Category 5e/6/6a connecting hardware as detailed in ANSI/TIA/EIA-568.
- L. Category 5e/6/6a Patch Cords. Patch cords shall be Category 5e/6/6a rated, 24 AWG, 4 pair assemblies. Patch cords shall be factory assembled by the manufacturer of the cabling system. LAN Patch cords shall be the same color, yellow or green, as the cabling system. The Premise Wiring CONTRACTOR shall provide and install Category 5e/6/6a patch cords as follows:
 1. One 2-meter Category 5e/6/6a patch cord for each work area outlet installed.
 2. In the wiring closets, Category 5e/6/6a patch cords shall be provided in a like manner - one per user port. Patch cords shall be provided in varying lengths to accommodate a patch that can be neatly loomed into the cable management system. In wiring closets and passive patch locations, all patch cords shall be installed and shall cross connect structured cabling to LAN equipment ports.
 - a. In IDF locations in cabinets with less than 26" rack space, Patch cables shall be provided in the following distribution of lengths – 30% 1 foot; 40% 2 feet; 30% 3 feet.
 - b. In IDF locations in stand-alone cabinets with between 26" and 56" of rack space, patch cords shall be provided in the following distribution of lengths – 60% 1 meter; 40% 2 meters.
 - c. In IDF locations in cabinets with more than 56" of rack space, or ganged cabinets, patch cords shall be provided in the following distribution of lengths – 20% 1 meter; 40% 2 meters; 40% 3 meters.
- M. Category 5e/6/6a patch cords for exterior locations: The patch cord shall combine existing Category 5e/6/6a RJ-45 plug technology with weatherproof assemblies and shall be compatible with standard Category 5e/6/6a RJ-45 connectors. One end of the ten foot patch cord shall be a Category 5e/6/6a RJ-45 plug embedded in a housing that creates an environmental seal, a strain relief, and a locking mechanism when mated to exterior Category 5e/6/6a connector, and an ingress protection of IP67. See Section 2.02 L of this Specification. The other end of the patch cord shall be a standard Category 5e/6/6a RJ-45 plug connector.
- N. Category 5e/6/6a Patch Panels. Patch Panels shall be provided in 24 or 48 port compliments with modular jack ports wired to T568B. Patch panels shall be augmented with cable support bars in rear to properly dress cable. All patch panels shall meet ANSI/TIA/EIA minimum requirements for return loss, propagation delay, delay skew, NEXT loss, PSNEXT loss, FEXT loss, ELFEXT, and PSELFEXT for Category 5e/6/6a connecting hardware as detailed in ANSI/TIA/EIA-568. Quantity and size of patch panels must be selected to provide 20% expansion capacity. One EIA rack unit of horizontal wire management shall be provided adjacent to each patch panel both above and below.

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- O. Outlet Gang Boxes. As a minimum, the telecommunications outlet box shall be capable of housing four Category 5e/6/6a terminations or two terminated optical fibers. The outlet box shall have the ability to secure the optical fiber cable and provide for a minimum fiber bend radius of 1 in. Typically, the telecommunications outlet/connector box shall consist of a 4 inch by 4-inch electrical box or surface mount box.
- P. Weatherproof single gang outlet box shall be NEMA 3R rated, either flush mount or surface mount as shown on the Drawings. The weatherproof single gang outlet box shall be used for mounting exterior Ethernet outlets. See Section 2.02.L of this Specification. This outlet box shall be mounted inside a terminal cabinet for exterior Ethernet outlet.
- Q. Faceplates. Faceplates shall be constructed of ABS molding compound and have the ability to accommodate one insert.
- R. Exterior faceplate shall be a single gang, two ports, and stainless steel plate. The faceplate shall be pre-punched for mounting use with weatherproof housing assemblies (Section 2.02 L.). The faceplate shall be gasketed and have an IP55 rating.
- S. Fiber Faceplates. Fiber faceplates shall be constructed of ABS molding compound and have the ability to accommodate a minimum of two angled duplex multi mode or single mode LC connectors.
- T. Horizontal Cable Management panels shall be 19-inch rack mount with a minimum of four-management rings one-rack unit (1.75 inches) in height. Rings shall not exceed more than 1.75 inches in depth unless otherwise noted in the construction documents.
- U. Floor Standing Cabinet. Floor-standing equipment cabinet for IDF installation use as required. Cabinet shall provide at least 84 inches (48 EIA/TIA rack units) of total mounting space for 19-inch panels and 36 inches of usable interior depth. If two cabinets are required in an IDF, all structured cabling components shall terminate within the same rack with the Backbone Switch. Cabinet shall be constructed of steel, with 14-gauge carbon steel front and rear adjustable mounting rails tapped for #10-32 screws on EIA spacing front and rear. Cabinet shall be tested and certified to the seismic specifications set forth by NEBS Telcordia Technologies GR-63-CORE. Cabinet shall be provided with a thermostatically controlled heat dissipation fan; textured antique finish; matching side panels and louvered top panel; a hinged, key locking, bronze-tinted acrylic window door in front keyed to Corbin Cat 90; and a full length, hinged, key-locking rear door keyed to Corbin Cat 90. Cooling fan thermostat shall be set at 78 degrees Fahrenheit. When installed, both doors shall be able to swing fully open. Cabinets shall be UL listed.
- V. Wall-Mounted Cabinet. Wall-mounted equipment rack for IDF locations. IDF cabinet shall provide at least 45 inches of mounting space for 19-inch panels (26 EIA/TIA rack units), a 22 inch main body and a minimum of 24 inches of usable interior depth. IDF cabinet shall provide at least 24 inches of mounting space for 19-inch panels (13 EIA/TIA Rack Units), a 22 inch main body and 24 inches of usable interior depth. Cabinet bodies shall be 14 gauge or better, all welded steel construction with 14-gauge carbon steel front and rear adjustable mounting rails, tapped for #10-32 screws on EIA spacing, fully adjustable front-rear. All hinges shall be heavy duty welded to cabinet body. Allowable deflection of an open cabinet, when loaded to its maximum weight capacity, shall not exceed .75 inches (3/4 inches) Wall mount cabinets shall be configured to have a minimum of 18 inches from front to rear rack-mounting rails. Cabinet shall have factory made top or side ventilation capability and a thermostatically controlled heat dissipation fan rated at no more than 32dBA, a Plexiglas front door, and flush mounted locks on both front and rear sections. The front lock shall be keyed to Corbin CAT 90 and the rear lock shall be keyed to Corbin CAT 90. Cooling fan thermostat shall be set at 78 degrees Fahrenheit. Cabinets shall be provided with white powder coat finish. Cabinets shall be UL listed.

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2.03 SIGNAL TERMINAL CABINETS

- A. Cabinets shall be code gauge galvanized steel or blue steel; fronts, doors, and trim shall be code gauge furniture steel. Cabinets shall be furnished with at least 6-inch high gutters at top and bottom where feeder cable size exceeds 4 gauge or where feeder cable passes through cabinet vertically. Cabinets shall be furnished with top and bottom gutters sized as required by inspection department having jurisdiction, but never less than 6 inches where more than one feeder enters top or bottom of cabinets. Side gutters shall not be less than 4 inches wide. Width of cabinets shall be 20 inches, unless otherwise indicated on Drawings.
- B. Doors shall be cut true, shall accurately fit opening and finish smooth across joints. Rabbets shall be inside. Door shall be sized as required to permit removal of devices intact. Gutters shall be provided at sides and top of compartment. Hinges shall be entirely concealed except for barrels and pins. Hinge flanges shall be welded to door and trim. Doors shall be equipped with flush type, spring-latching, Corbin locks for metal doors, keyed to Corbin No. 90 keys.
- C. Outdoor cabinets shall be NEMA Type 3R. Construction shall be formed from code gauge galvanized steel with ANSI No. 61 gray enamel finish. Provide heavy-duty, 3-point latching, vault type door handles with padlocking provisions. Provide stainless steel butt hinges on doors. Padlocks shall be furnished, keyed to Corbin No. 90 keys. Outdoor terminal cabinets shall be used only if approved by the OWNER.

2.04 TELEPHONE Systems

- A. Wiring:
 1. Telephone Trunk Cables: Cables shall be rated for inside installation, PVC insulated 22 AWG solid conductor cables unless otherwise specified by access provider. Cables shall be available in standard increments of 25, 50, 100, 200, 600, 800, 1,000 and 1,200 pairs. Any cable that exits the building must be rated for exposed environments and graded as outside plant cable.
 2. Installed telephone cable terminations, on 110-type terminating blocks, shall be installed in signal terminal cabinets, on ¾ inch plywood backboards, painted using fire-retardant paint. Cables shall be dressed in orderly fashion on entrance to the cabinets, properly secured with cable D-Rings that preclude snagging or inadvertent movement of the cables.
 3. Telephone Trunk Cables shall be terminated at the MPOE or IDF locations using 110 type blocks that meet Category 5e/6/6a data specifications (i.e., Siemons, or equivalent). Cross connects in the MPOE at these blocks will then distribute to interior PVC-jacketed, Riser grade, or outside Plant Grade cables that connect to individual IDF locations, depending on whether IDFs are located in the same building, a different floor, or in a different building.
 4. Category 5e/6/6a Cable, when used to connect voice telephones to the nearest IDF location shall carry the same rating and specifications as listed in the Local Area Data Networking (section 2.02). Category 5e/6/6a telephone wiring systems shall use blue or red-jacketed cable.
 5. Flooded Category 5e/6/6a cable for all underground applications: Category 5e/6/6a Cable, when used to connect voice telephones to the nearest IDF location shall carry the same rating and specifications as listed in the Local Area Data Networking (section 2.02).
 6. Category 5e/6/6a Inserts. All Category 5e/6/6a data inserts shall be wired to the T568B wiring pattern. Category 5e/6/6a data inserts shall meet ANSI/TIA/EIA minimum requirements for return loss, propagation delay, delay skew, NEXT loss, PSNEXT loss, FEXT loss, ELFEXT, and PSELFEXT for Category 5e/6/6a connecting hardware as detailed

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in ANSI/TIA/EIA-568. Inserts shall be blue or red in color as consistent with cable color for the system

7. Category 5e/6/6a Patch Cords. Patch cords shall be Category 5e/6/6a rated, 24 AWG, 4 pair assemblies. Patch cords shall be factory assembled by the manufacturer of the cabling system. Telephone system patch cords shall be the same color (blue or red) as the telephone cabling system.
8. Category 5e/6/6a Patch Panels. Patch Panels shall be provided in 12, 24 or 48 port compliments with modular jack ports wired to T568B. Patch panels shall be augmented with cable support bars in rear to properly dress cable. All patch panels shall meet ANSI/TIA/EIA minimum requirements for return loss, propagation delay, delay skew, NEXT loss, PSNEXT loss, FEXT loss, ELFEXT, and PSELFEXT for Category 5e/6/6a connecting hardware as detailed in ANSI/TIA/EIA-568 Quantity and size of patch panels must be selected to provide 20% expansion capacity. One EIA rack unit of horizontal wire management shall be provided adjacent to each patch panel both above and below.
9. Telephone Modular Jacks: CONTRACTOR Furnished, CONTRACTOR Installed (CFCI).
 - a. Provide modular jacks, 8-position, TIA-568, Category 5e/6/6a, using T568B wiring pattern. Jacks shall be UL verified and listed, Category 5e/6/6a with 110 contacts and blue or red in color whichever is consistent with the systems cable sheath color. Provide duplex faceplate mounting straps, where required. Provide wall and floor outlet plates as indicated in Section 16050: Basic Electrical Materials and Methods.

B. TELECOMMUNICATIONS RELATED EQUIPMENT

1. Telephone Type T7: CONTRACTOR Furnished, CONTRACTOR Installed (CFCI).
 - a. Type T7 shall be a modular telephone jack - type RJ-11 - on an independent line, separate from the telecommunications system. Provide independent line modular jacks at Administration fax machines two (2), each elevator room, pay telephones (typically at multipurpose room, gymnasium, and auditorium lobbies), and/or as indicated on Drawings. Each independent line will be terminated at the backboard in the MPOE. Termination of Category 5e/6/6a cable to an RJ-11 jack shall use the green and green/white conductors for typical tip and ring connections. The green conductor shall be terminated at the jack on the tip side.

PART 3 EXECUTION

3.01 PREMISE WIRING INSTALLATION

- A. Site Conditions: CONTRACTOR shall examine the areas and conditions under which the work of this Section will be performed. Unsatisfactory conditions shall be reported to OWNER before the CONTRACTOR begins work.
- B. Conduit Subsystem:
 1. Excavation.
 - a. Call the OWNER's Authorized Representative at least 48 hours prior to excavation.
 - b. Locate and protect existing construction, plant life and utilities. Before excavation, contact the "Underground Service Alert of Southern California" (USASC) for information on buried utilities and pipelines.
 2. Inter-building Conduits.

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- a. Provide and install 2 inner ducts of 1-1/2 inches and one inner duct of one inch with indexed pull cords.
 - b. Ductbanks shall have a continuous slope downward toward ground vaults and away from buildings with a pitch of not less than 4 inches in 100 feet.
 - c. Inter-building exterior and underground conduit runs shall not exceed 200 feet and shall not contain more than two bends of 90-degrees or less between pullboxes or vaults. Distances of up to 600 feet between underground pull boxes may be allowed if the conduit run between pull boxes has no bends, and is indicated on Drawings.
 - d. Stagger joints of the conduit by rows and layers so as to provide a duct line having maximum strength.
 - e. During and after construction, protect partially completed duct lines from the entrance of debris such as mud, sand, and dirt by means of suitable conduit plugs. As each section of a duct line is completed from ground vault to ground vault, draw a stiff bristle brush of the proper diameter through each duct until the conduit is clear of particles of earth, sand, and gravel; then immediately re-install conduit plugs.
 - f. Conduit fill shall not exceed 40%.
3. Intra-building Conduits
- a. Interior (all) conduits for multiple cables to communication outlets are to be a minimum of 1-1/4 inches and dedicated conduits shall serve outlet boxes.
 - b. No more than 6 feet of flexible conduit shall be used in any conduit run.
 - 1) Flexible conduit shall not be used in concealed or inaccessible areas such as interstitial wall spaces or hard lid ceilings.
 - 2) Where flexible conduit is used, the conduit fill shall be under rated by one trade size.
4. Entrance/Access Provider Conduits:
- a. Entrance Conduit for Telecommunications:
 - 1) Telecommunications entrance conduits for small and medium size sites less than 100 classrooms shall consist of One 4-inch trade size) conduit plus 1 spare of equal size.
 - 2) Telecommunications entrance conduits for large secondary school sites of 100 classrooms or more shall consist of Two 4-inch trade size conduits plus 1 spare of equal size.
 - 3) Each installed conduit shall be equipped with a 5/16-inch polypropylene pullrope.
 - 4) The primary entrance conduit shall be provisioned with two 1.5 inch and one 1-inch inner ducts each installed with indexed pull cords, unless AP representative indicates other requirements.
 - b. Entrance conduits for CATV Access Provider:
 - 1) CATV entrance conduit for all sites shall be One 3-inch trade size conduit.
 - 2) Each installed conduit shall be equipped with a 5/16 polypropylene pull rope.
 - c. Construction of underground ductbanks:
 - 1) Construct underground ductbanks of individual conduits encased in concrete. The concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least 3 inches of concrete cover for ducts.
 - 2) Separate conduits by a minimum concrete thickness of 3 inches. Provide plastic duct spacers between ducts, at a maximum 5-0 ft O.C.
 - 3) The top of the concrete envelope shall not be less than 24 inches below grade.

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- 4) Duct lines shall have a continuous slope downward toward ground vaults and away from buildings with a pitch of not less than 4 inches in 100 feet.
 - 5) Manufactured bends shall have a minimum radius of 36 inches.
 - 6) Stagger joints of the conduit by rows and layers so as to provide a duct line having maximum strength.
 - 7) During and after construction, protect partially completed duct lines from the entrance of debris such as mud, sand, and dirt by means of suitable conduit plugs. As each section of a duct line is completed from groundvault to groundvault, or groundvault to building, draw a brush through having the diameter of the duct, and having stiff bristles until the conduit is clear of all particles of earth, sand, and gravel then immediately install conduit plugs.
 - 8) No underground conduit run, without a pull box, is to be longer than 200 feet and shall contain no more than two bends of 90-degrees or less.
 - 9) Pull boxes or ground vaults shall not be used in place of conduit bends.
 - 10) Conduit types shall be limited to rigid metal conduit and schedule 40 PVC. Flexible metallic conduit and EMT shall not be used in entrance systems.
 - 11) Conduit shall be reamed to eliminate sharp edges and terminated with an insulated bushing.
 - 12) Joint trench methods shall not be used in entrance facility ductbanks.
- d. Ground Vaults and Pull Boxes.
- 1) Ground Vaults and pull boxes shall be installed in paved areas wherever possible. Top of box shall align with finish surface of paving. Wherever possible, install boxes where runoff water will not drain to the box. If vaults or boxes must be installed in an unpaved area subject to runoff, top of box shall be raised to allow no less than one inch of clearance from grade to top of box. In all cases, the top of vault or box shall be at or above the highest point in the runoff area.
 - 2) Provide pulling irons on opposite walls and below horizontal centerlines of ducts and cemented openings, and in bottom. Install pulling irons with each end hooked around a reinforcing bar.
 - 3) Install a floor drain into sump containing two cubic yards of crushed rock, minimum size 48 inches deep and 36 inches diameter. Provide a 36-inch length of 6-inch diameter perforated tile pipe extending down into sump and fill with gravel. Cover sump with grille.
 - 4) Install ground rod in each concrete pull box. Locate near a wall with 6-inch projection above floor for ground clamps. Permanently ground all metal equipment cases, cable racks, etc. in pull boxes. All ground conductors shall be #4-0 bare stranded copper.
- e. Above grade exterior and interior conduit systems
- 1) Conduits placed and mounted to exterior and interior portions of a building to extend conduit pathways from the ground vaults to the site's MPOP shall be Rigid Metallic Conduit (RMC).
 - 2) All conduits shall be bonded and grounded.
 - 3) Securely fasten all entrance conduits to the building so they can withstand a typical placing operation performed by the AP.
 - 4) Pull boxes, if needed, must be accessible. Do not place pull boxes above fixed ceilings, HVAC ducts, or piping.
 - 5) No interior conduit is to be longer than 100 feet between pull boxes, and shall contain no more than two bends of 90-degrees or less.

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- 6) Pull boxes shall not be used in place of conduit bends unless site conditions do not allow the use of conduits with data sweeps.
- 7) Where not required elsewhere in District Specification or Code, pull boxes shall be sized per the BICSI TDM 10th Edition, Chapter 5, Table 5.13.
- 8) An UL-approved fire stop applicable to the installation must be used when penetrating fire rated walls or floors.
- f. Conduit termination in MPOP.
 - 1) For conduits entering telecommunications room from below grade point, conduits shall extend 4 inches above the finished floor.
 - 2) For conduits entering from ceiling height conduits shall terminate 4 inches below the finished ceiling.
 - 3) Keep the area around an entrance conduit free of any construction, storage, mechanical apparatus, etc.
 - 4) Seal the inside- the- building end of a conduit to prevent rodents, water, or gases from entering the building. Use rubber conduit plugs, a water plug, or duct sealer, depending upon the conditions.
- C. Local Area Network IDFs.
 1. Backboards for IDFs shall be ¾-inch fire-retarding ACX plywood with the A side out and painted with two coats of flat light-colored fire-retarding paint on all sides. The size of the backboards will be determined by the size of the building and space provided.
 2. IDF Category 5e/6/6a Termination Installation.
 - a. Category 5e/6/6a patch panels shall be installed in 24 or 48 port compliments. CONTRACTOR shall provide and install all necessary patch cords, both copper and fiber optic, for internal cabinet interconnections.
 - b. One EIA rack unit of horizontal wire management shall be provided adjacent to each patch panel both above and below.
 - c. Cables shall be dressed and terminated in accordance with TIA/EIA-568, manufacturer recommendations, and this Specification.
 - d. Pair untwist at the termination shall not exceed one half an inch for Category 5e/6/6a connecting hardware.
 - e. Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.
 - f. Cables shall be neatly bundled, not overly tight, and dressed to their respective panels or blocks. Cable wraps shall not be tight enough to disturb the internal cable pair twists and positioning.
 - g. The cable jacket shall be maintained as close as possible to the termination point.
 - h. 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.
 - i. Patch cords used at the rack or cabinet shall include single-mode and multi-mode duplex fiber, and Category 5e/6/6a, 24 AWG, 4-pair assemblies, as required.
 3. IDF Fiber Termination Hardware Installation:
 - a. Stripped fiber slack shall be neatly coiled within the fiber termination panel. No stripped slack loops shall be allowed external to the fiber panels. Fiber loops must not be smaller than minimum bend radius of the cable.
 - b. All cables shall be individually attached to the respective termination panels by mechanical means.

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- c. Each fiber cable shall be stripped upon entering termination panels and the individual fibers routed neatly into termination panels.
- d. Each cable shall be clearly labeled at the entrance to the termination panel.
- e. Dust caps shall be installed on unused connectors and couplings.
- 4. Backbone Cabling:
 - a. Proper bending radius and pulling strength requirements of cables shall be followed during handling and installation. Cables, splice cases, punch-down frames, LIUs, patch panels and supporting hardware shall be installed in accordance with manufacturer recommendations.
 - b. Outside plant fiber shall be installed in 1-1/2 inch or one-inch corrugated inner duct installed within the backbone conduit.
 - c. Interior innerduct and cable shall be Plenum or Riser rated, as required by applicable code regulation or standard. Riser rated innerduct as a minimum shall be installed on floor-to-floor fiber optic cabling.
 - d. Interior fiber not installed in cable tray, conduit or raceways shall be installed in Plenum rated innerduct. Innerduct shall be installed properly strapped and supported every 4 feet in concealed spaces only. Innerduct shall be rated for indoor or outdoor use as applicable by code.
 - e. Cables in panels, cabinets, trays, and racks shall be neatly grouped and strapped using hook and loop cable straps. Cables shall be placed in a manner that allows equipment installation without rerouting. Full rack rail travel adjustments shall not be impeded by cable installation. Cables and panels shall be clearly identified at both ends with a unique cable numbering system and in compliance with TIA 606. Refer to Section 16135 for Cable Tray requirements.
 - f. When cable runs are being installed, provide additional slack at both ends to accommodate future cabling system changes. The minimum amount of allowable slack at the:
 - 1) MPOE shall be 10 feet.
 - 2) IDF shall be 3 feet.
 - 3) Include the slack in all length calculations to ensure that the cable does not exceed maximum allowable lengths as defined herein. Do not store slack in bundled loops. Store cable slack in an extended loop or in a figure 8 configuration to alleviate stress. Cable slack loops of any kind are not permitted in mid span for any J-Hook pathway.
 - g. The backbone fiber optic cable shall be installed in configurations based upon the physical topology and logical connections required as follows:
 - 1) If the MPOE-to-IDF cabling distance is 400 meters or less:
 - (a) The installed cable from MPOE-to-IDF shall be a minimum of 24 strands multi-mode and 12 strands single-mode.
 - (b) If the total combined length of the primary backbone plus the secondary backbone is less than 400 meters install additional multi-mode fiber optic strands in multiples of 12 including a minimum of 10% spare multi-mode fiber strands after all required fiber optic links are connected.
 - (c) If the total combined length of the primary backbone plus the secondary backbone is greater than 400 meters install additional single-mode fiber optic strands in multiples of 12 including a minimum of 10% spare single-mode fiber strands after all required fiber optic links are connected.
 - 2) If the MPOE-to-IDF cabling distance is greater than 400 meters:

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- (a) The installed cable from MPOE-to-IDF shall be a minimum of 24 strands single-mode.
 - (b) The single-mode and multi-mode fiber optic strands shall both be installed in multiples of 12 with a minimum of 10% spare single-mode fiber strands after all required fiber optic links are connected.
 - h. All fiber optic strands shall be terminated and no fiber cable shall be spliced.
 - i. Cable shall be installed in accordance with manufacturers' recommendations and best industry practices.
 - j. Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type.
 - k. Cables shall be installed in continuous lengths from origin to destination with no splices.
 - l. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
 - m. The CONTRACTOR shall replace any cable damaged or subjected to installation practices outside of those specified within this document.
- 5. Secondary Backbone Cable:
 - a. Fiber distribution cable for data circuits from IDF to shall be multimode or single mode fiber optic cable, OFNR or OFNP rated as required.
 - 1) All fiber cable shall be installed in conduit, cable tray, raceways, or in innerducts when installed in S-hooks. No cable shall be installed laying on ceiling tile. Cable supports shall be installed to independently carry the cable without pinching or crimping the cable in any way. The CONTRACTOR shall make an effort to vary the spacing of supports to prevent frequency dependent aberrations. All fiber hung on J-Hooks shall be installed in innerduct, with supports every four feet.
 - 2) Cable shall be installed in accordance with manufacturers' recommendations and best industry practices.
 - 3) Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type.
 - 4) Cables shall be installed in continuous lengths from origin to destination with no splices.
 - 5) When cable runs are being installed, provide additional slack at both ends to accommodate future cabling system changes. The minimum amount of allowable slack at the:
 - (a) MPOE shall be 10 ft.
 - (b) IDF shall be 3 feet.
 - (c) Include the slack in all length calculations to ensure that the cable does not exceed maximum allowable lengths as defined herein. Do not store slack in bundled loops. Store cable slack in an extended loop or in a figure 8 configuration to alleviate stress.
 - 6) The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
 - 7) J-Hook or trapeze system shall be used only if shown on drawings to support cable bundles in dropped ceiling or concealed ceiling spaces. J-Hooks shall not be used to distribute optical fiber cables within classrooms. All horizontal cables distributed using J-hooks shall be supported at a maximum of four-foot intervals and shall be in full compliance with the Codes and Standards as listed in Section 1.04 of this Specification. Cable slack loops of any kind are not permitted in mid span for any J-Hook pathway.
 - 8) At no point shall cable(s) rest on or attach to acoustic ceiling grids or panels.

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- 9) Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware.
 - 10) Cables shall not be attached to ceiling grid or lighting support wires.
 - 11) The CONTRACTOR shall replace any cable damaged or subjected to installation practices outside of those specified within this document and the Codes and Standards listed in Section 1.04 of this Specification.
6. Horizontal Cabling:
- a. Copper Horizontal distribution cable shall be TIA/EIA-568, Category 5e/6/6a, 4-pair unshielded twisted pair, and CMP or CMR rated cable, as required. Each Category 5e/6/6a cable shall be terminated on an 8-position, 8-conductor Category 5e/6/6a jack at the workstation location or on a patch panel in the MPOE/IDF. All terminations shall be wired in accordance with T568B. Associated faceplates shall accommodate four jacks. Quantities of cables to each outlet shall be in accordance with the location type and project document.
 - 1) Cable shall be installed in accordance with manufacturers' recommendations and best industry practices.
 - 2) Copper horizontal cable shall not exceed 90 meters in length.
 - 3) Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type.
 - 4) Cables shall be installed in continuous lengths from origin to destination, no splices or cross-connects are permitted).
 - 5) The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
 - 6) Unshielded twisted pair cable shall be installed so that there are no bends less than four times the cable outside diameter.
 - 7) When cable runs are being installed, provide additional slack at both ends to accommodate future cabling system changes. The minimum amount of allowable slack at the:
 - (a) MPOE, IDF will be 3 ft.
 - (b) Work Area Outlets will be 12 inches
 - 8) If a J-Hook or trapeze system is used to support cable bundles in dropped ceiling or concealed ceiling spaces, all horizontal cables distributed using J-Hooks shall be supported at a maximum of four-foot intervals. At no point shall cable(s) rest on or attach to acoustic ceiling grids or panels.
 - (a) Cable slack loops of any kind are not permitted in mid span for any J-Hook pathway.
 - (b) Cable installed above fire-sprinkler systems shall not be attached to the system plumbing or any ancillary equipment or hardware.
 - (c) Cables shall not be attached to ceiling grid or lighting support wires.
 - 9) Pulling tension on 4-pair UTP cables shall not exceed 25 pounds for a single cable or cable bundle.
 - 10) The CONTRACTOR will replace, before terminations are completed, any cables damaged or subjected to installation practices outside of those specified within this document, at CONTRACTOR's expense.
 - b. The following identifies the minimum number of Category 5e/6/6a and fiber drops to be installed into each area identified. Additional areas and additional drops may be required and will be identified on the project documents. Cable and termination requirements are identified in part 2.02 of this specification.

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- 1) Standard office, workstation, or cubicle will receive three (2) Category 5e/6/6a drops in a single 4-position faceplate. Two Category 5e/6/6a drops will be marked for Data, the other for Voice. Empty openings on faceplates shall be effectively closed using factory made blank inserts.
 - 2) Administrative office core areas shall receive three (2) Category 5e/6/6a drops in a single 4-position faceplate per user or desk indicated on the drawings. Two Category 5e/6/6a drops will be marked for Data, the other for Voice. Empty openings on faceplates shall be effectively closed using factory made blank inserts.
 - 3) Conference rooms will receive up to eight (8) Category 5e/6/6a drops; 4 each at two separate locations in the room. Each group of four drops will terminate in a single faceplate with two Category 5e/6/6a indicated for Voice and two for Data. Empty openings on faceplates shall be effectively closed using factory made blank inserts.
 - 4) Classroom: A minimum of four (4) student Category 5e/6/6a drops, and one (1) Category 5e/6/6a drop at the teacher's location. All classroom Category 5e/6/6a drops shall be distributed from the IDF location and terminate on two port faceplates. Empty openings on faceplates shall be effectively closed using factory made blank inserts
 - 5) Library: A minimum of four (4) Category 5e/6/6a data drops distributed from the IDF. Category 5e/6/6a drops must be grouped with two Category 5e/6/6a jacks and two blank jacks per faceplate. Drops must be distributed within the room according to the Project documents. Empty openings on faceplates shall be effectively closed using factory made blank inserts.
 - 6) Additional non-instructional and office work area horizontal fiber and Category 5e/6/6a cabling requirements will be indicated on the Project documents.
7. Labeling and Marking:
- a. Provide complete cable location chart and as-built documentation in an envelope and attach to the inside rear doors of distribution frame cabinets in wiring spaces.
 - b. Mark distribution panels, cables and cover plates with computer-generated labels. Drops shall be labeled with the same identifier on the receptacle faceplate, inside each junction box, on the cable at the jack, on the cable at the patch panel, on the termination side of the patch panel, and on the patch side of the patch panel. Cable markers shall be located within 2 inches of the end of the cable jacket and shall be directly readable. Panel labels shall be computer-generated and printed using a laser printer. A disk with the label files shall be submitted as part of the project record documents.

D. Racks/Cabinets:

1. Racks and cabinets shall be bolted to the floor or wall mounted, as required, and provided with all additional accessories as required for a complete functional system. Racks and cabinets shall be seismically braced and attached to horizontal ladder racking or cable tray with ¾ inch threaded rod.
2. MPOE/IDF cabinets shall be placed to accommodate 36-inch aisles in the front and rear. When wall mounted, cabinet placement shall allow a minimum of 31 inches clear on each side and 36 inches in front
3. Provide keys and locks for cabinets and equipment with locks keyed to a Corbin No. 60 key for access to operate equipment and Corbin No. 80 key for access to service equipment.

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- 8) H Horizontal – Data from IDF to User Jack
- b. Cable Types (Field #2):
 - 1) C Multi-pair copper cable
 - 2) F Multi-pair fiber optic cable
- c. Destination Number (Fields #3-5):
 - 1) Fields 3 -- 5 taken together will be a 3-digit sequential number identifying the IDF destination. The first digit of this destination number (field #3) will be structured to identify whether the destination is an IDF using the following convention:
 - 2) IDFs are identified in field #3 by the numbers “0” through “1”.
 - 3) For each situation, fields #4 and #5 will be a sequential number identifying unique, specific IDF locations.
 - d. By this convention, each IDF and will be represented by a unique three-digit number. IDFs will be numbered in the range 000—199
- e. Cable Number (Fields #6-8)
 - 1) This will be a unique and sequential three-digit number assigned to each cable sheath.
- f. Field #9 is reserved and will be represented using a dash “-”.
- g. Pair/Strand Number (Fields #10-12)
 - 1) This will be a unique and sequential three-digit number for each copper cable pair or fiber strand within a sheath.
 - 2) Note: Code “D” in the Cable Definition Field is a non-standard cable configuration and normally not used. OWNER serves voice jacks directly from IDF’s. The OWNER must approve, in advance of construction or installation, any installation that brings voice communications through an IDF.

3.05 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.07 OWNER ORIENTATION

- A. Completed shop drawings, as specified in Article 3.04 above shall serve as the OWNER’s orientation.

END OF SECTION

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4. If backboards are necessary for mounting IDF's, they are to be ¾ inch plywood, ACX grade surface with the "A" side exposed and painted with 2 coats of flat light, colored fire-retarding paint on all sides. The size of the backboards will be determined by the size of the space provided. All cut edges of plywood shall be sanded smooth.
5. Unused openings in cabinets shall be effectively closed.
6. Cabinet doors shall close without striking installed components.
7. Cabling in cabinets shall be installed and loomed in a manner that allows full travel in rack rail adjustment. Cabling shall not infringe on space used for equipment mounting.
8. Cabinets shall be grounded as specified in Article 250 of the California Electrical Code.
9. Conduits shall be installed so as to prevent moisture or water from entering and accumulating within the enclosure.
10. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.
11. Maintain the required bending radius of conductors inside the cabinet.
12. Clean the cabinets of foreign material such as cement plaster and paint.
13. Distribute and arrange conductors neatly in the wiring gutters.

E. Telephone Systems:

1. Terminals, Cabinets, and Racks: Telecommunications system and auxiliary cabinets/racks shall be installed and wall-mounted in accordance with Zone 4 seismic requirements and shall not block any existing removable panels or swing-open doors required for normal system expansion or service.
 - a. Terminal Blocks: See appendix 3 for typical network diagram.
 - b. Furnish terminal blocks in terminal cabinets/racks, and where indicated on Drawings, as required to provide a termination for conductors in communication cabinets/racks and backboards.
 - c. Terminal blocks shall be 110 Series, solder-less, push-on type, solid, and 22 - 26 AWG. Terminals for connections to external circuits shall be properly labeled. Terminal blocks shall be installed on mounting legs and installed within cabinets/racks as required. Terminal blocks shall be installed on inside back of cabinets/racks only, not on side. Cross-connect and wire management shall meet or exceed TIA/EIA-568, Category 5e/6/6a performance standards. Terminal blocks shall be pairs of 25 or 100 with mounting legs.
 - d. Terminal Cabinets/racks:
 - 1) Lines and cables within cabinets/racks and on main terminal backboards shall be secured with cable straps. Cables shall be formed in rectilinear configuration. Insulation between conductors and ground shall be properly maintained. Cables shall be properly numbered in numerical order and shall maintain the same numbering system throughout the Project site.
 - 2) Conductors shall be color-coded per EIA/TIA 568 standards. Individual cables shall be run out and tagged with laser-printed cable markers. Cable index strips shall be typed and installed on terminal cabinet door. Index strips shall be covered with clear plastic adhesive covers. Terminal cabinet cable codes shall be typed on record drawings.

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- 3) Terminations and connections shall be on 110 Series blocks. Cables shall be identified as to buildings and rooms served and terminated in terminal cabinets/racks and backboards.
 - 4) Cables to PA system consoles and amplifier inputs shall terminate on 110 Series blocks where PA system is required.
 - 5) Cables from PA consoles and amplifier outputs shall terminate on 110 Series blocks.
 - 6) Cables to telecommunications switches, trunk inputs, shall terminate on 110 Series blocks.
 - 7) Cables from telecommunications switches (extensions, consoles, night bells, etc.) shall be terminated on 110 Series blocks. Provide blocks and cables for maximum possible system configuration.
 - 8) Cables to satellite terminal locations and classrooms shall be terminated on 110 Series blocks. Provide blocks as needed, plus 2 vertical rows for future expansion, at main cross-connect locations only.
2. Wiring: Wiring within communication cabinets/racks and backboards shall be installed to conform to TIA/EIA-568, Category 5e/6/6a performance standards, and shall be terminated on terminal strips for all required external connections. Wiring shall be cabled, laced, and securely fastened in place so that weight is not imposed on equipment, controls, switches, or terminals. Input circuits and terminal strips shall be installed to provide separation necessary for proper operation. Wires shall be identified by number and chart, and 120VAC wiring shall be in a required conduit or raceway.
 3. Cables: All discussion of cable terminations and location of blocks are subject to provisions of the Terminal Signal Cabinet section above.
 - a. Install conductors and cables to devices indicated on Drawings. Provide conductor terminations to devices for complete telecommunications system to function as specified and as indicated on Drawings.
 - b. Cable runs shall be continuous, no splicing shall be allowed. Terminations shall be in communication cabinets/racks or on telephone backboards. Connections from incoming to outgoing shall be provided with cross-connect wires. Cables shall not directly connect to other cables.
 - c. Conductors and cables shall be installed within conduits, cable trays, boxes, raceways, and cabinets/racks in a manner, which shall provide an enclosed installation, except where otherwise specified. Furnish and install conductors to connect incoming and outgoing circuits, including spare conductors, to terminal strips in the LAN or telephone equipment room. All in accordance with TIA/EIA 569.
 - d. Cables and 4-pair wires shall be behind 110 Series blocks in space created by stand-offs and shall be neatly laced and securely bundled.

3.02 RELATED SYSTEMS INSTALLATION

A. Telephone Systems:

1. Coordination of Installation of Telecommunication Systems:
 - a. All Work, including installation or removal, will be coordinated with the OAR. CONTRACTOR shall be responsible for floor plans for cutover, station reviews, and cut sheets.
 - b. If the scope of the Work includes the extension and/or replacement of an existing telephone system, the cutover and station review must be coordinated with the OAR

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prior to implementation and every effort must be made to minimize interruption of service during the cutover or at any other time.

- c. Examination: The IOR shall observe installation of main cable runs. Notify the IOR not less than two (2) days in advance of proposed time of installation.

3.03 CERTIFICATION AND TESTING

- A. Provide the OWNER's Authorized Representative (OAR) with copies of factory calibration certificates for each test set used in the testing procedures. All test equipment used shall have been factory calibrated within the previous 12-month period. Operators of the test equipment shall have factory training in the use of the equipment and its software. All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by the CONTRACTOR 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.
- B. Local Area Network:
 1. Copper:
 - a. Each cable shall be tested for continuity on all pairs and/or conductors.
 - b. Enhanced Category 5e/6/6a data cable shall be performance verified using an automated test set for Category 5e/6/6a link configurations.
 - c. Test set shall be certified Level III. To ensure verifiable equipment calibration, the OWNER shall require field calibration each time a new set of tests are performed. Test for the continuity parameters defined above, and provide results for the performed tests. This test set shall be capable of testing for the continuity and length parameters defined above, and provide results for the following tests:
 - 1) Attenuation
 - 2) Wire Map
 - 3) Attenuation to Crosstalk Ratio (ACR)
 - 4) Pair-to-pair NEXT loss
 - 5) PSNEXT loss
 - 6) Return Loss
 - 7) Pair-to-pair ELFEXT
 - 8) PSELFEXT
 - 9) Propagation delay
 - 10) Delay skew
 - 11) Cable length
 - d. Cable length shall be tested using the cable manufacturers published Nominal Velocity of Propagation (NVP) parameter. OWNER's Quality Assurance Agent shall verify the NVP setting prior to commencement of the testing process. Generic settings not using the published NVP parameter will not be accepted.
 - e. Test results shall be automatically evaluated by equipment, using the most up-to-date criteria from the ANSI/TIA/EIA-568 standard and the result shown as pass/fail.
 - f. Test results shall be printed directly from the test unit in native format, and both hard and soft copies in native format shall be provided to the OWNER. The printed test results shall include tests performed, the expected test result, and the actual test result.
 2. Fiber Optics:

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- a. CONTRACTOR shall terminate, test and document all multi-mode and single-mode fiber optic cables with approved connectors at the drop locations and on approved fiber optic patch panels at the MPOE and IDF. No fiber optic cables shall remain un-terminated.
- b. Fiber optic cables shall meet all EIA/TIA performance standards and shall be tested in accordance with all applicable standards. Light source and power meter tests shall be dual wavelength and shall be tested in both directions at each wavelength on each fiber strand. Optical time domain reflectometer (OTDR) tests shall be performed with an instrument suitable for testing campus cable plants. OTDR tests shall be conducted at both wavelengths from the MPOE with sufficient launch cables installed at both ends of the fiber run to clearly identify the mated connectors. OTDR launch and landing cables shall not be less than 100 meters in length. The light pulse duration used shall not be greater than 50 nanoseconds. Sampling resolution shall not be less than 5 feet per 100 meters.
 - 1) Multi-mode fiber optic cable runs shall be tested in both directions at each frequency with a power meter and light source combination that can verify distance and attenuation. Wavelengths tested shall include 850nm and 1300nm.
 - 2) Single-mode fiber optic cable runs less than or equal to 400m shall be tested in both directions at each frequency with a power meter and light source combination that can verify distance and attenuation. Wavelengths tested shall include 1310nm and 1550nm.
 - 3) Single-mode fiber optic cable runs greater than 450m shall be tested with a power meter and light source combination and with an OTDR. Wavelengths tested shall include 1310nm and 1550nm.
3. Completion: CONTRACTOR's work for each school installation shall be considered complete after the following have been accomplished:
 - a. All system testing has been completed; CONTRACTOR certifies that entire system is in working order Cable Test Forms and equipment specific test documentation, both electronic files and paper records, have been submitted to the OWNER.
 - b. All ceiling panels previously removed have been put back in place.
 - c. All system labels have been put in place.
 - d. All construction debris and scrap materials have been removed from project site.
 - e. All marked up, project record documents have been returned to the OWNER.
 - f. All unused customer material has been returned to the OWNER.
 - g. The OWNER has successfully completed acceptance testing of the network wiring installation.
 - h. The OWNER's Inspector has inspected and accepted the installation.
- C. Signal Terminal Cabinets:
 1. Cabinets will be securely bolted to the floor and the wall or ceiling as required by seismic requirements.
 2. Cabinet will be serviceable and lockable.
- D. Telephone Systems:
 1. Provide test and reception gear to test for specified performance.
 2. For multi-pair copper communications cable, test all pairs within counts and binder groups to ensure that no less than 99% of the pairs of a multi-pair cable achieve continuity and

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operation in voice band tests. For Category 5e/6/6a copper cable, test and certify 100% of all drops for using test equipment certified for 10/100/1000 validation and operation.

3. For Category 5e/6/6a cabling, all requirements of section 3.03A above
4. Before Substantial Completion, submit test results and related documents to the IOR.

3.04 PROJECT RECORD DOCUMENTS

A. As-Built Documentation:

1. Block diagrams indicating all items and their point-to-point connections in a manner following floor plan layout.

B. Operating and Servicing Manuals, Record Drawings:

1. Deliver three (3) copies of operating, specification descriptions, and/or service manual. Each complete manual shall be bound in a three-ring binder, and all data shall be typewritten or drafted.
 - a. Each manual shall include a page with Project site and Project name, date of Substantial Completion, CONTRACTOR name, address, telephone, and fax numbers.
 - b. Each manual shall contain a letter, signed by an officer of the company indicating the beginning and ending date of any warranties described in subsection 1.07 of this specification and shall describe the companies' commitment to service the warranty during the terms specified.
 - c. Each manual shall include all specifications and instructions necessary for proper operation and servicing of system.
 - d. Each Manual shall include installation and coordination drawings specifically related to this section shall be included as follows:
 - 1) Size A (8-1/2 inch x 11 inch) and size B (11 inch x 17 inch) shall be bound into the manual.
 - 2) Larger drawings shall be folded and inserted into transparent envelopes and bound into the manual.
2. Deliver two (2) copies of Record drawings on USB flash drive representative of the work performed shall be presented at completion of work in the most recent Autodesk's AutoCAD format or Microsoft Visio, for Microsoft Windows.
 - a. The submittal shall contain all systems wiring installed including telephone, LAN, and any other low voltage system CONTRACTOR-installed wiring.
 - b. The submittal shall consist of two electronic copies on USB flash drive and three paper record copies on no less than "E" size drawings, presented prior to the acceptance inspection.
 - c. OWNER utilizes layers as a key tool in controlling visibility of drawing elements and to provide consistent information between drawings, yet provide control over what is seen on each sheet. Premise wiring shall be shown on a separate layer, labeled as "Premise Wiring" that uses both building floor plans and conduit supporting structure layers below. The use of any version control blocks or company logos shall be on a layer separate from the premise wiring as-built drawings.
 - d. All electronic files supplied shall be multi-layer drawings with the following layers as a minimum:
 - 1) Layer 1 shall contain title blocks only.
 - 2) Layer 2 shall contain building or site plan backgrounds only.

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- 3) Layer 3 shall contain terminal cabinets, devices, cabling and other system components.

C. Cable Numbering Records:

1. OWNER requires both labeling and record documentation at the conclusion of each cable installation project. Labels and cable records allow the OWNER to locate, identify and diagnose cases of trouble more efficiently. They are required for each cable installation project regardless of size and scope.
2. Installation CONTRACTOR shall provide a cable management spread sheet that shall include the following:
 - a. Cable Schedule/
 - b. Cable Test Forms.
 - c. Cable Labels.
 - d. Network planning chart.
3. Present the data in an Excel spreadsheet that will operate on Windows XP/ Windows 7 platforms. Information shall be presented in paper and electronic forms in a format that will be provided by the OWNER.
4. A paper copy of the cable schedule in a transparent plastic sleeve shall be affixed to the front door of each Intermediate Distribution Frame (IDF). In the IDF cabinet, the cable schedule shall be affixed to the rear door of the cabinet.
5. The following information is provided to assist ARCHITECTS, engineers and installation CONTRACTORS in understanding and complying with the requirements of this specification. OWNER's cable numbering is based on a defined format which readily identifies cable type, and allows maintenance technicians to determine originating and terminating locations by means of cable labels, as required in other sections of the specification.
6. Refer to Attachment 2 for a diagram that describes all functional cabling and network connection elements standardized by the OWNER. This cable information is consistent with but exceeds the requirements of EIA/TIA Specification 606. Terminating Points In (TPI) and Terminating Points Out (TPO) may be 110-Type blocks, 110-Type blocks, 24 or 48 density RJ-45 Patch Panels, or Fiber Optic Patch Panels. Termination point equipment is not part of cable records.
7. Each cable sheath shall be identified by laser-generated labels, and on the cabling record document by means of a 9-digit alpha/numeric number. In addition to the 9-digit sheath/cable number, CONTRACTORS will need to provide 3-digit, numeric pair/strand-numbering information specific to each cable/sheath number. The pair/strand number will be documented in the cable record document. Refer to Attachment 3 for definitions and use of each field.
8. The following are the permissible characters that may be entered into each field.
 - a. Cable Definitions (Field #1):
 - 1) T Trunk – Voice from MPOE to IDF
 - 2) W Wide Area – Data from MPOE to IDF
 - 3) F Feeder – Voice from MPOE or PBX to IDF
 - 4) B Backbone – Data from MPOE to IDF
 - 5) D Distribution – Voice from IDF (see note below)
 - 6) S Secondary Backbone – Data from IDF
 - 7) B Building cable drops – Voice from IDF to User Jack

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SECTION 27 41 16 - INTEGRATED AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: Audiovisual systems – presentation systems, control systems, and interface with outer systems.
- B. Base bid work
 - 1. Provide equipment and materials, whether specifically mentioned herein or not, needed for a complete and operating audiovisual systems to satisfy the requirements of this section and related drawings. This specification lists major equipment but not every wire, connector, extender, converter, fastener, etc., needed to complete the work.
 - 2. Provide coordination with electrical work necessary to provision AV equipment with power in areas where equipment is relocated. The work may require relocation of power outlets or extending power outlets to alternate locations within the same room. Refer to the attached campus survey for overall field conditions.
 - 3. Equipment racks or enclosures:
 - a. Plenum enclosures: Provide plenum-rated equipment enclosures, including frame, side panels, top panels, access doors, anchorage and seismic bracing, integrated power outlets and cooling provisions as required.
 - b. Provide standard or custom accessories and mount adapters for equipment installed in equipment racks or enclosures as needed to properly mount equipment, power supplies, accessories, components, and the like. Provide cable management to properly route and mind wires, cables, and cords.
 - c. Provide power receptacle strips in quantities needed to supply power to the equipment within the rack.
 - d. Provide spare rack mounting screws. Determine based on rack mount units (RUs) – 1 spare screw per 2 RU installed, minimum.
 - e. Provide bonding for racks, cabinets, equipment, equipment support and cable/wire management to an approved grounding point.
 - 4. Cooling provisions
 - a. Provide cooling provisions (means to move heat out of enclosed spaces to prevent temperatures from exceeding equipment manufacturer's specified maximums). Ensure equipment operates within manufacturer's cooling guidelines. Provide only code-compliant cooling provisions (e.g., exhausting from one space to another).
 - b. In racks, enclosures, millwork, cabinets, and other spaces where equipment will be installed and prone to heat buildup, provide thermostatically controlled active cooling devices to create adequate airflow through the enclosed space. Examples of active cooling devices include vent fans. At a minimum, ensure airflow by installing active cooling devices or systems such as fans.
 - 5. Provide power controllers (such as an IP power strip connected to the network or controllable through the room control system) to devices that cannot inherently be remotely controlled for power cycling. Verify functional operation for specified control operations.
 - 6. Labeling: Provide labeling for audiovisual system components. The components include, but are not limited to, the following:

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- a. Equipment racks and equipment enclosures
- b. Rack-mounted equipment and devices: Provide a label on the back of each piece of equipment. If a serial number (of a given piece of equipment) is not visible in a final installed condition, provide a label on the equipment on a visible location duplicating the serial number.
- c. Wall-mounted equipment and devices: Provide an equipment label on the back of each piece of equipment. If a serial number (of a given piece of equipment) is not visible in a final installed condition, provide a label on the equipment on a visible location duplicating the serial number.
- d. Provide an equipment plate for each piece of equipment.
- e. Provide a label for each control that is not inherently labeled, such as those in racks and user spaces.
- f. Wires and cables: Provide a cable label at each end of each piece of wire, cable and cord.
- g. Terminal blocks, patch panels, and other termination apparatus: Provide a label on each termination block, piece of termination apparatus and termination position on patch panels.
- h. Handheld, lavalier, wireless, and other microphones and associated equipment (such as receivers)
- i. User interface devices/plates
7. Coordination requirements
 - a. Coordinate with the construction team at large to ensure that equipment and other system components will be installed properly, and that there will be no compromises due to, among other aspects, spatial conflicts or power service incompatibilities.
 - b. Coordinate with the electrical contractor for power requirements and service connection to the System's equipment.
 - c. Coordinate with the telecom contractor and other trades/contractors (as needed) placement of cables and wires when sharing pathways (such as cable tray) with other low voltage systems. Do not place cables and wires into pathways provided by others without permission.
 - d. Coordinate with the telecom contractor (or Owner) for locations within racks for installing equipment"
 - e. Coordinate with the Owner (or Owner's network provider) for network configurations and/or settings required for the System's proper or correct operation.
- C. Related divisions and sections: Consult other divisions where applicable, determine the extent and character of related work.
- D. Products furnished but not installed under this section
 1. None
- E. Products installed but not furnished by contractor
 1. Telephone instruments for classrooms – OFE
 - a. The contractor is responsible for providing a 2-post network outlet for an OFE telephone for each classroom.
 - b. The contractor is responsible for installing the telephone instrument.
 - c. Network switches, with Power over Ethernet (PoE)
 2. Telephone patch cable

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- F. Products specified but not installed under this section None
- G. Products furnished and installed by this contractor, either directly or by subcontracting to a qualified licensed 3rd party:
 - 1. Rough-in (device boxes, conduits, and related accessories)
 - 2. Relocation or provision of electrical service (e.g., 120 VAC)
 - 3. Telecommunication cabling
- H. Alternates: Submit a written request for modification to an installation practice desired or required which is contrary to these specifications or drawings. Obtain written approval from the Owner prior to performing modifications.
- I. Unit Prices: Submit unit prices, as derived from the quotations in the Schedule of Values, for adjustments to the contract price. Include in unit prices, material, both explicitly specified, as well as additional components required for a complete and functional installation, labor, shipping, tax, markups (overhead, profit, job expenses, bond), labeling, records, and as-built drawing production costs.

1.02 REFERENCES

- A. General
 - 1. Codes, standards, and industry manuals/guidelines listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Consider such codes and/or standards a part of this specification as though fully repeated herein.
 - 2. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
 - 3. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid unless otherwise specifically stated.
- B. Codes: Perform work and furnish materials and equipment under Division 27 in accordance with applicable requirements of the latest edition of governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:
 - 1. California Code of Regulations (CCR):
 - a. Title 8, "Industrial Relations"
 - 1) Chapter 3.22, "California Occupational Safety and Health Regulations (CAL/OSHA)"
 - b. Title 24, "California Building Standards Code"
 - 1) Part 1, "California Building Standards Administrative Code"
 - 2) Part 2, "California Building Code" (CBC)
 - 3) Part 3, "California Electrical Code" (CEC)
 - 4) Part 11, "California Green Building Standards Code" (CALGreen)"
 - 2. National Fire Protection Agency (NFPA)
 - a. NFPA 75, "Protection of Information Technology Equipment"
 - 3. United States Department of Labor (DOL) Occupational Safety and Health Administration (OSHA) Regulations (Standards - 29 CFR)
 - a. Part 1910, "Occupational Safety and Health Standards"
 - b. Part 1926, "Safety and Health Regulations for Construction"

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4. Code of Federal Regulations (CFR) Title 47 "Telecommunication", Chapter I "Federal Communications Commission (FCC)":
 - a. Part 15, "Radio Frequency Devices and Radiation Limits"
 - b. Part 27, "Miscellaneous Wireless Communications Services"
 - c. Part 68, "Connection of Terminal Equipment to the Telephone Network"
 - d. Part 90, "Private Land Mobile Radio Services"
5. Other applicable national, state, and local building and fire codes
- C. Standards: Perform work and furnish materials and equipment under Division 27 in accordance with the latest editions of the following standards as applicable:
 1. Building Industry Consulting Services International (BICSI):
 - a. Telecommunications Distribution Methods Manual (TDMM)
 - b. Customer-Owned Outside Plant Design Manual
 - c. Wireless Design Reference Manual (WDRM)
 - d. Network Design Reference Manual (NDRM)
 2. EIA testing standards
 3. National Electrical Contractors Association (NECA):
 - a. ANSI/NECA 1, "Standard Practices for Good Workmanship in Electrical Construction"
 4. Telecommunications Industry Association (TIA):
 - a. ANSI/TIA-568-C.0, "Generic Telecommunications Cabling for Customer Premises"
 - b. ANSI/TIA-568-C.1, "Commercial Building Telecommunications Cabling Standards - Part 1 General Requirements"
 - c. ANSI/TIA-568-C.2, "Balanced Twisted Pair Telecommunications Cabling and Components"
 - d. ANSI/TIA-568-C.3, "Optical Fiber Cabling Components"
 - e. ANSI/TIA-569-B, "Commercial Building Standard for Telecommunications Pathways and Spaces"
 - f. ANSI/TIA/EIA-598-B, "Optical Fiber Cable Color Coding"
 - g. ANSI/TIA-606-B, "Administration Standard for Telecommunications Infrastructure"
 - h. ANSI-TIA-607-B, "Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises"
 - i. ANSI/TIA-758-A, "Customer-Owned Outside Plant Telecommunications Infrastructure Standard"
 5. ANSI/TIA-1005, "Telecommunications Infrastructure Standard for Industrial Premises" National Fire Protection Agency (NFPA)
 - a. NFPA 262, "Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces"
 6. Underwriters Laboratories (UL)
 - a. UL 969, "Marking and Labeling Systems"
 - b. UL 1419, "Professional Video and Audio Equipment"
 - c. UL 60065, "Audio, Video and Similar Electronic Apparatus – Safety Requirements"
 7. InfoComm
 - a. InfoComm 1M, "Audio Coverage Uniformity in Enclosed Listener Areas"
 - b. InfoComm 2M "Standard Guide for AV Systems Design and Coordination Processes"
 - c. InfoComm 3M, "Projected Image System Contrast Ratio"
 - d. InfoComm F501 01, "Cable Labeling for Audiovisual Systems"
 8. "Sound Systems Engineering", 3rd Ed., Davis and Davis
 9. Electronic Components Industry Association (ECIA)
 - a. EIA/ECA-310, "Cabinets, Racks, Panels, and Associated Equipment"

1.03 DEFINITIONS

- A. The definitions of Divisions 00 and 01 shall apply to Division 27 sections.
- B. In addition to those definitions of Divisions 00 and 01, the following list of terms as used in this specification defined as follows:

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1. "AFF": Above Finished Floor
2. "As directed": As directed or instructed by the Owner, or their authorized representative
3. "AHJ": Authority Having Jurisdiction
4. "Cabling": installed media ready for electronic or optical signal circuit use; a complete media connection comprised of cables, termination apparatus (patch panels, blocks, connectors), outlets, connecting media (path cord, cross connects), labeling
5. "CBC": California Building Code (CCR Title 24 Part 2)
6. "CCR": California Code of Regulations
7. "CEC": California Electrical Code (CCR Title 24 Part 3)
8. "Connect": To install patch cords, equipment cords, cross connect wire, etc. to complete an electronic or optical signal circuit
9. "Cord": a length of cordage having connectors at each end. The term "Cord" is synonymous with the term "Jumper" and "Lead"
10. "ENG": Engineer
11. "Furnish": To purchase, procure, acquire, and deliver complete with related accessories
12. "GC": General Contractor
13. "Identifier": A unique code assigned to an element of the Telecommunications infrastructure that links it to its corresponding record
14. "Install": To set in place, join, unite, fasten, link, attach, set up or otherwise connect together and test before turning over to the Owner, parts, items, or equipment supplied by contractor or others. Make installation complete and ready for regular operation
15. "IOR": Inspector Of Record
16. "ISP": Inside Plant
17. "LED": Light Emitting Diode
18. "MSDS": Material Safety Data Sheets
19. "NEC": National Electrical Code (NFPA 70)
20. "NEMA": National Electrical Manufacturers Association
21. "NFPA": National Fire Protection Agency
22. "NIC": Not In Contract (work or equipment)
23. "OFCI": Owner-furnished contractor-installed; coordinate the integration of components furnished by the Owner; provide mounting hardware, cable, connectors, etc. to ensure proper integration of OFCI equipment
24. "OFE": Owner Furnished Equipment
25. "OSP": Outside Plant
26. "Owner": Hewlett Packard Enterprise, Inc.
27. "Owner's Representative": Tracy Martin
28. "PDF": portable document format (electronic file format / *.pdf)
29. "Pigtail": a length of cordage having connectors at one end
30. "Provide": To furnish, transport, install, erect, connect, test and turn over to the Owner, complete and ready for regular operation
31. "UL": Underwriters Laboratories:
32. "ACEG": alternating current equipment ground (an example of this is a ground bus within an electrical panel)
33. "Approved Grounding Point": an approved grounding point is one that satisfies the applicable electrical code and provides a low impedance path to earth. Examples include the following though may manifest in different means: a telecommunications grounding busbar (such as for bonding an equipment rack within a telecom room), the ACEG of the electrical panel serving the equipment requiring bonding to ground (such as for bonding a credenza rack within a conference room), or the ground conductor of a branch circuit (such as for bonding a single piece of equipment).
34. "A/R": Indicates that the quantity of an item is as required to meet the design criteria indicated in the audiovisual drawings.
35. "A/S": Indicates that the quantity of an item is as shown on the drawings.
36. "Audience Area": the portion of a presentation space intended to be occupied by an audience. An audience area includes the primary seating and standing spaces and may

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include the adjacent circulation spaces. An audience area generally excludes spaces reserved for presenters.

37. "Custom" indicates systems or components the Contractor fabricates based on these specifications and drawings
38. "EDID": Extended display identification data
39. "HDCP": High-bandwidth digital content protection
40. "HDMI": High-definition multimedia interface
41. "OFE": Owner Furnished Equipment
42. "Or equal" indicates an item that is equal in function and performance to the specified device or system
43. "RU": rack unit, as defined in EIA/ECA-310
44. "Shall" denotes a mandatory requirement
45. "Should" denotes an advisory statement
46. "SPL": sound pressure level
47. "THD": total harmonic distortion
48. "Will" denotes an informative statement
49. "Project": The scope of work defined by this specification and its related drawings
50. "Software": Any executable programs, parameter files, user interfaces, or other coded content that are required to operate, control, or maintain the audiovisual systems in this Project
51. "Custom Created Software": Any software, parameter files, user interfaces, or other coded content created for the control or operation of the audiovisual systems in this Project
52. "Third-party software:" Any programming developed by a party other than the AV Contractor and the Owner to be used to operate, control, or maintain the audiovisual systems in this Project
53. "System": The audiovisual components, cabling, and programming incorporated in the descriptions and equipment lists herein

1.04 SYSTEM DESCRIPTION AND PERFORMANCE REQUIREMENTS

- A. General
 1. In circumstances where the specifications and drawings conflict, the drawings govern quantity and the specifications govern quality.
 2. The contract drawings and specifications convey design intent. They are not intended to be used in lieu of shop drawings.
- B. ADA compliance: Provide the following:
 1. Accessible control systems
 2. Assistive listening systems -
- C. Audio system
 1. Provide echo cancellation for microphones in audio and video conferencing systems.
 2. Program audio system:
 - a. Frequency Response: 100 Hz to 12,000 Hz. 3 dB per octave roll off below 100Hz and above 12 kHz.
 - b. Total Acoustical Harmonic Distortion: Less than 2% at 90 dBC (1 kHz reference) at four feet (1,220 mm) above finished floor in the middle of the room.
 3. Distributed audio system:
 - a. Frequency Response: 125 Hz to 10,000 Hz. 3 dB per octave roll-off below 125 Hz and above 10 kHz.
 - b. Total Acoustical Harmonic Distortion: Less than 2% at 85 dBC (1 kHz reference) at four feet (1,220 mm) above finished floor in the middle of the room.
 4. Signal to noise ratio (mixer input to amplifier output): 75 dB from 50 Hz to 15 kHz minimum.
 5. Frequency response with equalizers bypassed: less than ± 1 dB from 50 Hz to 12 kHz.
 6. Distortion: less than 0.5% at 1 kHz at the equipment's rated input signal level.

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7. Output levels (in audience areas without objectionable distortion, rattles, or buzzes, employing as test signals several different samples of recorded music and microphones applied at each system input):
 - a. Program audio: not less than 95 dB
 - b. Speech reinforcement: not less than 85 dB
8. Hum and Noise: inaudible (below the background noise level of the space) under normal operation observed in audience areas.
- D. Video system resolutions
 1. Provide system components with a minimum resolution capability of 1920 X 1080
 2. Provide systems that support the following resolutions: 1,280 x 720, 1,920 x 1,080, 1,920 x 1,200, 3840 X 2160, and 4096 x 2160.
- E. Direct-view display systems
 1. Provide displays that have no more than seven defective pixels per quadrant, or per manufacturer's spec.
- F. Wireless systems
 1. Ensure that wireless AV systems do not create radio frequency interference to other systems.
 2. Demonstrate at AV acceptance testing that wireless AV systems are not adversely affected by AV- related nor other radio frequency sources.
- G. Control system
 1. Provide user interfaces, such as control panels, that respect ergonomics and varying levels of technical ability among users. Follow these guidelines:
 - a. Avoid abbreviations
 - b. Size lettering at 1/8" minimum
 - c. Maintain background to lettering contrast
 2. Positive logic: Avoid conditions which may cause command synchronization conflicts (i.e., alternate action (toggling) on/off without power reset or feedback. Provide power sensors or other devices where necessary to ensure that positive logic conditions are maintained.
 3. Timing: Prevent two or more commands being sent simultaneously to the same piece of equipment.
 4. Linking: Provide linking of functions to require the fewest number of user actions to effectively control the equipment.
 5. Clearing: Ensure that each media selection clears the previous audio and visual selection (e.g., selecting COMPUTER clears the audio and video section of the previous Blu-ray disk selection).
 6. Defaults: Establish default power-up conditions for the system including device audio levels, warm- up routine, power conditions, switcher status and other default conditions as required by the Owner or Owner's representative.
 7. Volume Memory: Provide easy-to-use memory for volume settings associated with each source device. Unless directed otherwise in this document, provide programming that maintains these settings between alternate selections during each use – through power-on and power-off.
 8. Status indication: Program buttons for both touch panels and pushbutton panels to provide clear status indication using illumination when back-lighting is available or by changing color.
 9. Failsafe: Provide program that ensures that no operation or sequence of operations causes the control system to become inoperable or interferes with further processing, correct operations or execution of commands.
- H. Centralized Management Procedure
 1. Provide server-based software for the management of the AV systems deployed in the facility and the District. Include the following:
 - a. Help-desk functionality
 - b. Enterprise-wide scheduling and monitoring
 - c. Time-stamped AV systems data collection for reporting
- I. Room types

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1. For each room, adapt the audiovisual system to best suit the architectural layout such that each room of a certain type is similar to others of its type, with minor layout differences to accommodate architecture.
2. Refer to the drawings and survey for the quantities of each type of room and for specific audiovisual interface information per room.
3. Standards Classroom Types
 - a. Type 1 – Flexible, dual projection, extended desktop
- J. It is possible that certain portions of the system described herein will be ready for use prior to the completion of the entire scope of this specification. The Owner reserves the right to use substantially completed systems without obligation to the Contractor and without implying final acceptance of the systems or equipment so used.
- K. Room Functionality Descriptions
 1. Standard Classroom Type 1 – Dual projector, extended desktop, ceiling mounted speakers
 - a. Flexible in configuration, dual projection systems with projector and projection screen, with one projector displaying the main output of the instructor's laptop and the second projector displaying the extended desktop of the laptop
 - b. Technology connection point at the front of the room for an instructor lectern containing:
 - 1) Connection for laptop, including HDMI with multiple adaptors for DisplayPort, Mini DisplayPort and VGA for legacy support including audio
 - 2) Document camera
 - c. Portable device sharing capability (BYOD)
 - d. Supporting AV presentation system, including switching and amplification functions
 - e. Ceiling-mounted speakers
 - f. Control system, self-contained, with push-button style panel, to control all functions of the AV systems
 - g. Assistive listening system as required by code
 - h. OFE Telephone installed by light switch bank

1.05 SUBMITTALS

- A. Submit required submittals to the Owner in the quantities and formats as required under the general contract. In the absence of requirements, provide as described in the following with reference to quantity and format.
- B. Failure to comply with requirements in part or whole shall constitute grounds for rejection.
- C. Resubmittals: For resubmittals, provide a cover letter with the resubmittal that lists the action taken and revisions made to each product in response to the Engineer's submittal review comments. Lack of this actions-taken cover letter shall constitute grounds for non-review and/or rejection of resubmittal packages.
- D. Bid submittal: Submit bids in accordance with project's overall bidding requirements, and include the following requirements of this section.
 1. Site visit: As possible, visit the site before submitting your bid. Coordinate site visit arrangements with the District. Include date of site visit in the bid submittal.
 2. Firm information and qualifications: Include detailed information about the firm, including but not limited to the following, in the bid:
 - a. Firm's history – how long the firm has been in business, how long the firm has offered audiovisual systems integration services, etc.
 - b. Annual revenue for the three most current years
 - c. Bonding capacity and bonding insurance agent contact information
 - d. Three successfully completed projects of similar scope within the past 24 months. For each project, include the owner/client name, contact information (person's name, position, and telephone number or email address), project location, type of systems installed, total contract amount, date completed, and services included (e.g., engineering, installation, integration, maintenance, etc.).

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- e. Industry affiliations
- f. Advanced certifications (CTS-I/D, DMC-D/E, ACE-D/I/P/RMS, XTP, etc.)
- g. Manufacturer certifications
- h. Contractor license number for the state where the work will take place
- i. Union affiliation(s)
3. Personnel and certifications: Include information on key personnel in the bid.
 - a. Include résumés and certifications for personnel who will be assigned to the project including but not limited to the Project Manager, Systems Engineer, Field Installation Supervisor, Lead Control System Programmer, and other key personnel.
 - b. Include résumé(s) of CTS-I (Certified Technology Specialist – Installation) certified personnel
 - c. Include résumé(s) of DMC-E (DigitalMedia Certified Engineer) certified personnel.
 - d. Include résumé(s) of Q-Sys Level 2 (QSC Certification) certified personnel.
 - e. Include other relevant company-held industry, manufacturer, and educational certifications and designations for involved personnel
4. Subcontract information: Indicate in the bid, all subcontractors and their responsibilities and qualifications.
5. Schedule of values: Include a schedule of values in the bid. Break out the schedule of values into three areas – equipment costs, non-equipment costs, and service contract.
 - a. Equipment costs: List equipment costs (each piece of equipment), including required modifications and accessories.
 - b. Non-equipment costs: List non-equipment costs, such as the following:
 - 1) General and Administrative: shipping, insurance, and guarantees, etc.
 - 2) Fees: e-Waste/disposal, permits, etc.
 - 3) Engineering: design, drawings, run sheets, instruction manuals, etc.
 - 4) Pre-installation: fabrication, modification, assembly, rack wiring, etc.
 - 5) Installation: installation, coordination, supervision, testing, etc.
 - 6) Owner training: training session(s), manuals, etc.
6. Alternates/substitutions:
 - a. Submit bids based on the specified equipment. If the bid includes proposed alternates and/or substitutes, separate these from the costs of the equipment as specified and include for alternate equipment full technical information and cut sheets. Proposed alternate equipment will receive consideration if the differences between the specified and alternate/substituted equipment do not depart from the design intent and function of the system and are in the best interests of the Owner. If the inclusion of substituted equipment will result in a different connection configuration than that in the bid documents, include drawings that illustrate how the proposed system would be connected.
 - b. Only one substitution for each product specified will be considered.
 - c. Where products are noted as "or equal", a product of equivalent design, manufacture, and performance will be considered. Submit product data (product information, catalog cuts, pertinent test data, etc.) to substantiate that the product is in fact equivalent to that specified. The burden of proof that the substituted product is equivalent to the specified product rests with the Contractor. Whenever material, process or equipment is specified in accordance with an industry specification (ANSI, TIA, etc), UL rating, or other association standard, present an affidavit from the manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, submit supporting test data to substantiate compliance.
 - d. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the contract documents are used to establish standards of quality, utility and appearance. Materials, processes or equipment that, in the opinion of the Engineer, are equivalent in quality, utility and appearance will be approved as substitutions to that specified when "or equal" follows the manufacturers' names or model number(s).

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- e. When the Engineer accepts a substitution in writing, it is with the understanding that the Contractor guarantees the substituted product, component, article, or material to be equivalent to the one specified and dimensioned to fit within the construction according to contract documents. Do not provide substituted material, processes, or equipment without written authorization from the Engineer. Assumptions on the acceptability of a proposed substitution, prior to acceptance by the Engineer, are at the sole risk of the Contractor.
- f. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the work, or from provisions of the specifications.
- g. Pay expenses, without additional charge to the Owner, in connection with substitution materials, processes and equipment, including the effect of substitution on self, subcontractor's or other Contractor's work.
7. System enhancements: Include in the bid recommendations, if any, that will enhance the performance and/or functionality of the system, or will reduce costs without loss of performance/functionality. Recommendations that are of value to the Owner will be taken into consideration in the evaluation of the bids. Make such proposed recommendations as "alternates", with the appropriate cost modifications shown separate and apart from the costs of the system "as specified".
8. Exceptions: In the bid, explain exceptions, if any, to these specifications and related drawings. In the absence of exceptions, these specifications and related drawings are binding in letter and intent.
9. Guarantee compliance with requirements and regulations in effect on the job site. Explicitly state any such non-compliances or conflicts in the bid submittal. The bidder has the responsibility to investigate potential contract, union, and scheduling issues, and to notify the general contractor of such.
- E. Pre-construction submittals
 1. Product data: Prior to purchase and installation, submit as a PDF file information (such as cut sheets, etc.) for equipment, components, products, etc., that will be installed as part of the work of this section.
 - a. Include in the submittal, a Table of Contents, listing equipment, components, products, etc., by room, by system, and/or by other logical designation. A continuous list of all products with no reference to where the products will be installed will be rejected. Incomplete lists will be rejected.
 - b. Indicate (arrow, highlight or other designator) on each product's cut sheet the manufacturer, model/part number, accessories (as applicable), options (as applicable), color (as applicable), and other information to indicate the exact item to be installed. Where this information is not already provided on the cut sheet, manually input this information and a brief description (as applicable).
 2. Shop drawings: Submit shop drawings prior to installation and in accordance with the Conditions of Contract and Division 1, including the following.
 - a. Prior to the start of work, submit shop drawings and obtain written approval from the Engineer for the shop drawings submittal.
 - b. Quantity and Media: Submit shop drawings as described in Division 01. In the absence of requirements given, submit shop drawings as directed in writing either an electronic submittal (preferred) via approved means (email, e-transmit, FTP upload) or four printed and bound sets on bond.
 - c. Format:
 - 1) Use the same sheet size as the contract drawings.
 - 2) Use the same title block as the contract drawings, modified to include contractor information.
 - 3) Text: 3/32" - 1/8" high when plotted at full size.
 - 4) Use identical symbols as those in the contract drawings.
 - 5) Screen background information.

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- 6) Plot system components (symbols, outlet, devices, pathways, cable routes, etc.) and text using a heavier line weight sufficient enough to stand out against background information.
- 7) Scaling:
 - a) Scale floor plans and reflected ceiling plans at 1/8"=1'-0"
 - b) Scale enlarged room plans at 1/4"=1'-0"
 - c) Scale wall elevations at 1"=1'-0"
 - d) Scale rack elevations at 1"=1'-0"
- d. Functional line diagrams for all systems – clearly tag each item with name, manufacturer, and manufacturer's model number (e.g., "Program Amplifier LabGruppen LUCIA 60/2M") and show the terminal number or input/output designation (e.g., "Mic 1-In", or "Record Out-Left").
- e. Provide schematic diagrams of custom circuitry such as receptacle pin numbers and component callouts; show details of custom resistive attenuation and/or combining networks, filters, or pads which may be required in the assembly; show point to point wiring drawings for control system modules and interfaces, and for switches and relays in audio, video, or control systems
- f. Equipment rack elevations and patch panel assignments – clearly and consistently label rack elevations, patch panels, and on equipment controls.
- g. Provide pushbutton and handheld remote control panel layouts –tag each button with function and ID matching installed labels
- h. Factory and custom panels, plates, and designation strips, showing material, finish, color and engraving (exact lettering)
- i. Equipment modifications (if any), including details of modifications that change or void manufacturers' warranties.
- j. Cable run lists – clearly show at each terminal point the type of connector to be used; include typical wiring details of each connector; note where shields are connected and where they will float to ensure the integrity of the shielding system; indicate cable types and, where appropriate, color codes; assign wire numbers and patch bay locations to every wire and patch point in the drawing
- k. Wattage tap setting per loudspeaker.
3. Touch screen submittal:
 - a. Provide a PDF per system containing a page for each menu, submenu, and popup in that system's user interface. Include menus that are manually triggered and those that automatically appear as the result of events such as the connection of a source device. Ensure that the PDF is unlocked so that the Engineer may annotate it.
 - b. If the development environment allows, provide an executable menu simulation file or web link for control systems in addition to a PDF-based submittal.
4. Network coordination: Submit as an Excel file or cloud-based collaborative spreadsheet (such as Google Sheets) a list of equipment that will be connected to the network, including but not limited to the following (e.g., spreadsheet column headers):
 - a. Item number
 - b. Description
 - c. Manufacturer
 - d. Model/part number
 - e. MAC address
 - f. IP address type (DHCP or static)
 - g. Power-over-Ethernet (PoE) requirements (yes or no)
 - h. Specific network and/or subnet configuration requirements
 - i. Specific QOS requirements
 - j. Anticipated network traffic
5. Testing equipment and procedures:
 - a. Submit a list of test equipment, including manufacturer, model number, and description that will be used for testing and adjustment of the installed systems.

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- b. Submit testing procedures to be performed during pre-functional testing and acceptance testing, including the minimum acceptable outcome for each test.
- F. At the completion of the installation
 1. Initial Testing and Tuning Report: After completing initial testing and tuning, checkout, settings, as-built drawings, and operational documentation, submit written notification to the Owner and Architect that initial checkout is complete. Include in this notification a completed Initial Testing and Tuning Report that satisfies the requirements of Part 3. In the Report, document the results for tests performed during initial testing and tuning. Organize the report per room, per system, and per test. Include the testing tools/equipment, manual and automated tests, testing procedures, and expected result per test. If the test equipment stores test results and has the capability to produce reports, also include these reports.
 2. Wireless microphones frequencies. Submit a list of wireless microphone frequencies and associated channels used for each microphone and system.
- G. Closeout Submittals
 1. Acceptance Testing Report: After completing final acceptance testing, final tuning and settings, submit an Acceptance Testing Report that documents the results for tests performed during final testing and tuning. Organize the report per room, per system, and per test. Include the testing tools/equipment, manual and automated tests, testing procedures, and expected result per test. If the test equipment stores test results and has the capability to produce reports, also include these reports. Include the system's normal settings.
 2. As-built drawings: Submit as-built drawings in accordance with the Conditions of Contract and Division 1, including the following.
 3. Quantity and Media: Submit as-built drawings as described in Division 01. In the absence of requirements given, submit as-built drawings as directed in writing as electronic files via approved media (or four printed and bound sets on bond, if approved).
 4. Format:
 - 1) Use the same sheet size as the contract drawings.
 - 2) Use the same title block as the contract drawings, modified to include contractor information.
 - 3) Text: 3/32" - 1/8" high when plotted at full size.
 - 4) Use symbols identical to the symbols shown on the contract drawings.
 - 5) Screen background information.
 - 6) Plot system components (symbols, outlet, devices, pathways, cable routes, etc.) and text using a heavier line weight sufficient enough to stand out against background information.
 - 7) Electronic files shall be native format and plotted PDF files. The file names shall include the sheet number.
 - b. Submit as-built drawings that fully represent actual installed conditions and that incorporate modifications made during the course of construction.
 - c. Symbols List
 - d. Diagrams, such as (but not limited to) point-to-point diagrams, block diagrams, riser diagrams, line diagrams, and other diagrams that conceptually describe the system
 - e. System functional line drawings for all systems; clearly tag each item with name, manufacturer, and manufacturer's model number (e.g., "Program Amplifier Lab.Gruppen LUCIA 60/2M") and show the terminal number or input/output designation (e.g., "Mic 1-In", or "Record Out- Left").
 - f. Point-to-point wiring diagrams for switches and relays in audio, video, and control systems; point-to-point wiring diagram for control system modules and interfaces
 - g. Schematic diagrams of custom circuitry such as receptacle pin numbers and component callouts; show details of custom resistive attenuation and/or combining networks, filters, or pads which may be required in the assembly
 - h. Equipment rack elevations and patch panel assignment drawings. Clearly label the rack elevations, patch panels, and equipment controls.

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- i. Cable run lists – clearly show at each terminal point the type of connector to be used; include typical wiring details of each connector; note where shields are connected and where they will float to ensure the integrity of the shielding system; indicate cable types and, where appropriate, color codes; assign wire numbers and patch bay locations to every wire and patch point in the drawing
- j. Pushbutton and handheld remote-control panel layouts, including tagging each button with function and ID that matches installed labels
- k. Factory and custom panels, plates, and designation strips, showing material, finish, color and engraving (exact lettering)
- l. Wattage tap setting per loudspeaker.
5. System Operation and Maintenance (O&M) manual:
 - a. Describe typical procedures necessary to activate each system for full functionality as required under the System Description.
 - b. Describe normal settings for equalizer, amplifier, signal processing, and user operated controls (as established during system check out) in tabular or pictorial form.
 - c. Outline a recommended maintenance schedule with reference to the applicable pages in the manufacturer's maintenance manuals. Where inadequate maintenance information is provided by the manufacturer, provide the information necessary for proper maintenance.
 - d. Outline a recommended plan for a normal maintenance period of at least one year, including a list of necessary and recommended replacement parts.
 - e. Assume the reader of this manual to be technically competent, but unfamiliar with this particular facility.
 - f. Submit equipment manufacturers' operation and maintenance manuals for each piece of equipment.
6. Programming/software:
 - a. Submit the project's control system programming and audio processor configuration files – refer to "Software License" below.

1.06 QUALITY ASSURANCE

- A. Audiovisual Contractor requirements: Demonstrate that your firm meets or exceeds the following requirements:
 1. Five years' experience, minimum, with the design, engineering, assembly, installation, start-up and maintenance of audiovisual systems of similar or greater complexity to those identified in this specification
 2. Provide the necessary professional design, engineering, fabrication, installation, and project management personnel to execute the work of this section, and to guarantee a complete, functional system in compliance with the design intent
 3. Successfully completed in the past 24 months a minimum of three projects of similar scope
 4. Current state contracting license, as required to perform the work under this section
 5. Bondable to 100% of contract value
 6. Be an authorized supplier and installer for equipment listed in this section
 7. Maintain permanent fabrication, service and support facilities within 100 miles of the Project site.
- B. Audiovisual Contractor certifications: Demonstrate that your firm has the following certifications:
 1. An InfoComm CTS-I (Certified Technology Specialist-Installation) certified employee to actively manage this project – the Engineer will verify CTS credentials at the InfoComm website.
 2. An Extron Control Specialist-certified employee to be actively involved in the design, implementation and commissioning of systems in this project – the Engineer will verify Control Specialist with Extron.

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3. A QSC Q-Sys Level 2 certified employee to be actively involved in the design, implementation and commissioning of systems in this project – the Engineer will verify Q-Sys credentials with QSC.
- C. Manufacturer/equipment supplier requirements: Demonstrate that your firm meets or exceeds the following:
 1. Operate their business for not less than five years
- D. Subcontractor quality:
 1. Specifically identify in the bid submission, for Owner, Architect, or Engineer's approval, all subcontractors that will be used.
 2. Regardless of any subcontract arrangement, your firm will have sole responsibility for the successful implementation of the work in this section.

1.07 PROJECT MANAGEMENT AND COORDINATION

- A. Project Management and Coordination Services
 1. Provide a project manager for the duration of the project to coordinate this Work with other trades. Coordination services, procedures and documentation responsibility include, but are not limited to, the items listed in this section.
 2. Review of Shop Drawings Prepared by Other Subcontractors:
 - a. Obtain copies of shop drawings for equipment provided by others that require telecommunication service connections or interface with work.
 - b. Thoroughly review other trades' shop drawings to confirm compliance with the service requirements contained in the Division 27 contract documents. Document discrepancies or deviations as follows:
 - 1) Prepare memo summarizing the discrepancy
 - 2) Submit a copy of the specific shop drawing, indicating via cloud, the discrepancy
 - c. Prepare and maintain a shop drawing review log indicating the following information:
 - 1) Shop drawing number and brief description of the system/material
 - 2) Date of the review
 - 3) Name of the individual performing the review
 - 4) Indication if follow-up coordination is required
 3. Should existing conditions prohibit construction progress as submitted and approved, coordinate the adjusted installed locations with the other contractors (AV, electrical, etc).
- B. Concurrent Installation
 1. The network will be installed concurrent with the work of Division 27. Coordinate your work with the Owner's/network integrator's work. For example, coordinate scope and dates for rack and cabling (terminations) readiness to allow the network integrator to plan and schedule installation of the network equipment (for example, access switches).
- C. Role of the Engineer
 1. The Owner has retained the Engineer's services through construction. During construction, the Engineer will work with and assist the Contractor as follows (in general):
 - a. Review product data and shop drawings submittals for general compliance with the contract drawings and specifications.
 - b. Provide interpretation and clarification of project contract documents
 - c. Reply to (and 'process') relevant Requests for Information (RFIs)
 - d. Review changes as they arise, and confirm that the proposed solutions maintain the intended functionality of the system.
 - e. Interpret field problems for Owner, and translate between Owner and Construction Team.
 - f. Review the testing procedures to confirm compliance with industry-accepted practices.
 - g. Observe the work for general compliance with the contract documents and to ensure that the installation meets the design intent of the system, and report progress to the Owner.

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- D. Assign a project manager to this project for the entire duration. They shall oversee the design, submittals, implementation, testing, and close out – the entire process from start to finish. The project manager shall also coordinate this work of this section with other trades.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Delivery
1. Do not deliver products to the site until protected storage space is available.
 2. Coordinate materials delivery with installation schedule to minimize storage time at jobsite.
 3. Deliver materials in manufacturer's original, unopened, undamaged packaging and containers with identification labels (name of the manufacturer, product name and number, type, grade, UL classification, etc.) intact.
 4. Immediately replace equipment damaged during shipping at no cost to the Owner, so as not to impact the construction schedule.
- B. Storage and Protection
1. Store materials in clean, dry, ventilated space free from temperature and humidity conditions (as recommended by manufacturer) and protected from exposure to harmful weather conditions.
 2. Comply with manufacturer's storage requirements for each product. Comply with recommended procedures, precautions or remedies as described in the MSDS as applicable.
 3. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic.
 4. Storage outdoors covered by rainproof material is not acceptable.
 5. Provide heat where required to prevent condensation or temperature related damage.
- C. Handling
1. Handle materials and equipment in accordance with manufacturer's written instructions. Handle with care to prevent damage, breakage, denting, and scoring.
- D. Do not install damaged materials and equipment. Replace damaged equipment at no cost to the Owner.

1.09 WARRANTY

- A. Warrant the System for a minimum of one year from the date of system acceptance by the Owner. Honor component warranties per manufacturers' terms if greater than one year.
1. Include service as described in 3.13 "Maintenance and Extended Service" in the warranty.
- B. Activate manufacturers' equipment warranties in the Owner's name. The warranty period shall commence on the date of System Acceptance by the Owner.
1. In the case of contractor-modified equipment (where the manufacturer's warranty could be voided), warrant such equipment equivalent to that of the original manufacturer.
- C. Warrant the Software and version updates – see "Software" below.

1.10 SOFTWARE LICENSE

- A. Nondisclosure
1. During or after the termination of this Agreement, the Owner agrees not to disclose any proprietary information provided by the AV Contractor, to maintain such information as confidential and not use such information provided in Project documents for any purpose other than maintenance and support of in-house systems. This does not apply to any of the information that becomes generally known to the public due to publication or other legal means and through no fault of the Owner.
- B. Obligations governing the Software

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1. The AV Contractor shall own the copyright of any custom created software/parameter files ("Software") and hereby grants the Owner a royalty-free, non-exclusive license to use the Software for use with the audiovisual and other connected systems in this project. This license cannot be transferred.
 2. The Owner shall not rent, loan or re-license rights to use the Software to any third party.
 3. Any Third-party software provided or made available to the Owner by the AV Contractor, but not created by the AV Contractor, is sublicensed to the Owner through the AV Contractor. The AV Contractor agrees that such sublicense is granted with consent of the third-party at no cost to the Owner, and the Owner shall be entitled to use such software under the same terms as the AV Contractor.
 4. The AV Contractor and third-party suppliers are not restricted from licensing the Software or any portion thereof to other customers.
 5. At acceptance testing, provide the source code for custom created software, applications required to use the source code, descriptions of the required equipment, and instructions detailing the modification and installation of the Software to the Owner.
- C. For project and custom Software, the following apply.
1. Provide the source code to the Owner either directly via file transfer or make it available through other means, such as cloud storage, an FTP site, etc. Maintain older versions within a folder structure and make them available to the Owner at the Owner's request. At the end of the warranty period, release the current and older versions of the source code to the Owner. If the AV contractor ceases to exist during the warranty period, release the source code to the Owner upon termination of the business.
 2. Provide the Software in a form suitable for immediate access by the System.
 3. The AV contractor grants the Owner the right to modify and to enhance the Software as furnished and licensed under the terms of this Agreement at its own risk and expense, and further agrees such modifications and enhancements developed by the Owner to be the property of the Owner. Any changes to the custom created software parameter files do not affect copyright ownership.
 4. During the warranty period, if the Owner discovers that the Software is no longer functioning in the same manner as had been approved at the beginning of the warranty period, they shall document the fault in sufficient detail to allow errors to be reproduced, and they will notify the AV contractor. Within two business days of this notification, update the software, provide or post updated Software files as detailed above, demonstrate that the error has been resolved, and maintain updated Software files as detailed above.
 5. Defend any suit brought against the Owner and pay any damages due to the resulting judgment from any suit brought against the Owner as it pertains to a violation of copyrights or patents of the Software or licenses. The Owner shall notify the AV contractor in writing promptly and give authority, information and assistance at the AV Contractor's expense.
 6. The AV contractor at its own expense and option shall, if able, procure for the Owner the right to continue to use the Software as licensed or to replace it with a non-infringing release. This shall not include any agreement by the AV Contractor to accept liability for patent or copyright infringement for beyond the Software as licensed and furnished for the Project. This also excludes any agreement by the AV contractor to accept liability for patent or copyright infringements for methods and processes to be carried out by using said Software except those inherent in the furnished System.
 7. All contracts with Third-party software suppliers will transfer from the AV Contractor to the Owner at Project acceptance by the Owner.
 8. The Owner shall apprise the AV Contractor of activities it takes with Third-party software providers during the warranty period. Included activities would include discontinuing the use of any Software component, installing updated or alternate versions of the Software, revising the configuration of affected systems.
 9. The Owner can contact the AV Contractor for questions at no additional cost during the warranty period, providing:
 - a. The queries are related to the audiovisual systems defined in this document.
 - b. The query is asked by the Owner's staff or authorized representative.

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- c. The inquirer has attended the AV Contractor's or the manufacturer's training in the use of the systems defined in this document.
- d. The question is not intended as design consultation.
- 10. The Owner can only make copies as backup files of the Software and they are required to include the AV Contractor's copyright notice. The Owner shall make a reasonable effort to secure this Software to prevent theft or unlicensed usage.
- D. Software license terms
 - 1. The Software license is granted by the AV Contractor for the devices provided for the Systems. If any devices in the system fails, the license can be transferred to a replacement device on a temporary or permanent basis if the original device is to be phased out. The transference may only occur with written notification to the AV Contractor.
 - 2. Additional licenses or changes to the Software are subject to a supplemental agreement between the AV Contractor and the Owner.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Materials used shall present no environmental or toxicological hazards as defined by current industry standards and shall comply with OSHA and EPA standards, other applicable federal, state, and local laws.
- B. Product numbers are subject to change by the manufacturer without notification. In the event a product number is invalid or conflicts with the written description, notify the Owner in writing prior to ordering the material and performing installation work.
- C. Provide products, equipment and software that are the latest version of the specified model or type available at the time of procurement, providing the updated devices provide the same or better capabilities and performance required by the system design.
- D. Where denoted "or equal", equal products will be considered. The manufacturers, product numbers, and types listed at those instances establish minimum performance. Unless noted on the equipment list, it is not intended to exclude other products whose performance is equivalent to those named.
- E. Substitutions: The Engineer may consider substitutions for certain equipment if the Contractor demonstrates that the substitution meets or exceeds the functional requirements described in the System Description and Performance Standards. Follow the requirements of section 012500 "Substitutions" for substitution requests.
 - 1. Substitutions: Submit substitution requests based on the specified equipment and including associated equipment costs separate from the costs of the equipment as specified.
 - a. Proposals for alternate equipment will receive consideration if the differences between the specified and alternate/substituted equipment do not depart from the overall intent of the design and operation of the system and are in the best interests of the Owner.
 - b. Include full technical information and cut sheets for the proposed substitutions.
 - c. If the inclusion of substituted equipment will result in a different connection configuration than that in the bid documents, produce drawings that illustrate how the proposed system would be connected.
- F. Demolition:
 - 1. The contractor is responsible for removing unused or abandoned equipment in the classroom and moving it to a location within the facility designated by the Owner.
 - 2. The contractor is responsible for removing and disposing of abandoned or unused conduit in the classrooms under the scope of work.

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2.02 EQUIPMENT SCHEDULE

- A. Quantities: Quantities are either listed herein with a number, as "A/S" (as shown), or as "A/R" (as required). If listed as A/R or the quantity is marked with an asterisk, determine quantities as required for a fully operational system. Confirm the quantity listed here against the drawings.
- B. Centralized Software-Based Management
1. Provide a web-based AV resource management and remote control application to manage, monitor, and control AV equipment and other devices using a standard TCP/IP network.
 - a. Extron Global Viewer/Global Configurator
 - b. Or Equal
- C. Wi-Fi HD Camera System
1. Provide a Wi-Fi enabled camera system, minimum 1080P resolution, to view and transmit wirelessly to the room's projector or video system.
 2. The system shall be portable, applicable to rooms where skills need to be demonstrated.
 3. Include portable cart or stand and receiving devices for a turn-key solution.
 - a. Mevo
 - b. Or Equal
- D. Room Types
1. Standard Classroom– Dual projector, extended desktop
- E.

Description	Make	Model	Qty.	Notes
CATEGORY: AUDIO				
Speakers, ceiling-mounted	Extron Or Equal	SM28-T	A/R	Provide option for FF120
Assistive Listening System	Listen Technologies Or Equal	Portable 72	A/R	
ALS Support system	Extron or Equal	WPD-101	3	
Voicelift Pro Receiver	Extron or Equal	VLR 302	3	
CATEGORY: VIDEO				
Interactive Laser display short-throw projector	Epson Or Equal	BrightLink 1485Fi 1080p 3LCD	6	

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Description	Make	Model	Qty.	Notes
Single Channel Streaming Media Processor	Extron or Equal	SMP 111	3	
Video Extender Set, HDMI, shielded CAT6 interconnect	Extron Or Equal	DTP HDMI 4K 230 TX DTP HDMI 4K 230 RX	A/R	
Collaboration System, Wireless	Extron Or Equal	ShareLink Pro 500	3	
Document Camera, HDMI, interactive	Elmo Or Equal	TT-12iD	3	
Power Injector for XTP	Extron or Equal	XTP PI 100	3	
CATEGORY: CONTROL				
7" Pro Touchpanel Control Keypad	Extron Or Equal	TLP PRO 725T	3	
CATEGORY: ACCESSORIES				
Wall Plate, HDMI	Extron Or Equal	DTP T HWP 4K 231 D	6	
Mobile AV Cart	Spectrum Industries	Inspiration Plus	3	

2.03 CABLES AND WIRES

- A. Provide cables and wires that are continuous - without splices.
- B. Cable selection
 1. Refer to functional diagrams for signal type between equipment.
 2. Select a cable with the appropriate rating and configuration required by the applicable building code, electrical code, AHJ, and applicable codes and regulations governing the installation.
 3. For cables that will be installed in conduit within on-grade concrete, select a cable rated for underground construction.
 4. For cables that will be installed outdoors in underground conduit, aerial, and/or corrosive environments, select a cable rated for outdoor construction.
 5. For signal extenders, use extender the manufacturer's recommended cable type and within the maximum cable run length to be used.
- C. Unless otherwise called for in these specifications and drawings, the following cables are approved for the associated application or signal type. Ensure the chosen cable is appropriate for the signal type, available pathway capacity, and run length.

Application	Non-Plenum Product	Plenum Product
Ethernet	Refer to PCCD Telecom Standards	Refer to PCCD Telecom Standards

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HDBaseT	West Penn 4246F Belden AV6SHR Extron XTP DTP 24 Superior Essex 6H-246-xA Or equal by Liberty, Crestron	West Penn 254246F Belden AV6SHP Extron XTP DTP 24P Superior Essex 6H-246-xB Or equal by Liberty, Crestron
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2.04 EQUIPMENT PLATES

- A. For equipment plates, utilize 1/32" to 1/16" thick by 1/4" high aluminum with a brushed anodized black finish.

Control cable	West Penn 77350 Liberty LLINX-U Or equal by Belden, Crestron	West Penn D25350 Liberty LLINX-U-P Or equal by Belden, Crestron
Microphone and line-level audio cable	West Penn 454 Liberty 20-2C-SH-GRY Or equal by Belden, Canare, Mogami	West Penn 25291B Liberty 20-2C-PSH-WHT Or equal by Belden, Canare, Mogami
Program loudspeaker cable	West Penn 227 Liberty 12-2C-GRY Or equal by Belden, Canare	West Penn 25227B Liberty 12-2C-P-BLK Or equal by Belden, Canare
Distributed loudspeaker speaker cable	West Penn 224 Liberty 18-2C-GRY Or equal by Belden, Gepco	West Penn 25224B Liberty 18-2C-P-BLK Or equal by Belden, Gepco
ALS emitter	See Antenna cable (wireless microphone) – 50-ohm, below	
Antenna cable (wireless microphone) – 50-Ohm	West Penn 813 Liberty RG8-CMR-BLK Or equal by Belden	West Penn 2598G8 Liberty RG8-CMP-BLK Or equal by Belden

- B. Provide engraved lettering 1/8" to 3/16" high.

2.05 EQUIPMENT LABELS

- A. For equipment labels, utilize white, self-laminating, machine-printable, permanent adhesive-backed tape, 3/8" to 1/2" high.
- B. Provide text using black 12-point Helvetica, or a visually similar, san-serif typeface.
- C. Manufacturer, or equal:
1. Brady
 2. Brother
 3. DYMO XTL or Rhino
 4. Panduit
 5. Thomas and Betts

2.06 WIRE AND CABLE LABELS

- A. Use either of the following label types for wire and cable labels:
1. Tape – machine-printable, wrap-around, self-laminating, permanent adhesive-backed tape
 2. Machine-printable, shrink-wrapped labels
- B. Provide labels with a white face stock (print area).

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- C. Size as needed per wire/cable size.
- D. Provide labels that meet UL 969 requirements.
- E. Manufacturer, or equal:
 - 1. Brady
 - 2. Brother
 - 3. DYMO XTL or Rhino
 - 4. Panduit
 - a. #S100X075YAJ; self-laminating cable label, white face stock 1" wide, diameters 0.08"-0.16"
 - b. #S100X125YAJ; self-laminating cable label, white face stock 1" wide, diameters 0.12"-0.28"
 - c. #S100X150YAJ; self-laminating cable label, white face stock 1" wide, diameters 0.16"-0.32"
 - d. #S100X225YAJ; self-laminating cable label, white face stock 1" wide, diameters 0.24"-0.48"

2.07 RACK BONDING

- A. Rack busbars
 - 1. Application: for consolidating bonding connections to approved ground, with pre-drilled holes for approved bonding connections.
 - 2. Material: Copper (referred) or copper alloy
 - 3. UL Listed
 - 4. Manufacturer, or equal:
 - a. CPI #10610-019; horizontal rack busbar, 19"
 - b. CPI #40160-036; vertical rack busbar, 36"
 - c. CPI #40160-072; vertical rack busbar, 72"
- B. Bonding conductors
 - 1. Type: THHN (THWN will be accepted)
 - 2. UL Listed as type THHN per Standard 83.
 - 3. Conductor: soft drawn annealed copper, stranded
 - 4. Gauge: 6 AWG, minimum, or as shown on the drawings
 - 5. Insulation: PVC, high-heat and moisture resistant
 - 6. Jacket: Nylon, abrasion, moisture, gasoline and oil resistant
 - 7. Color: green
 - 8. Flame Resistance: Meet the flame resistance requirements of IEEE 383, CSA FT-4 and UL VW-1.
 - 9. Manufacturer, or equal:
 - a. Southwire
- C. Bonding connectors
 - 1. Two-hole, standard (or long) compression-type barrel lug, 1/4" dia. x 5/8" on center
 - 2. UL Listed, for the purpose used
 - 3. Manufacturer, or equal:
 - a. Panduit #LCD6-14A-L, compression lug for 6 AWG conductor
 - b. Thomas & Betts #54205, compression lug for 6 AWG conductor

PART 3 - EXECUTION

3.01 GENERAL

- A. Perform work in accordance with the standards and best practices defined by the InfoComm International coursework for Installation 1: System Fabrication and Installation 2: Setup and Verification.
- B. Install products per manufacturers' instructions.
- C. Install panels, equipment, boxes, etc., plumb and square.

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D. Seismic safety:

1. Mount, anchor and/or brace permanently installed equipment to the building structure using anchors, fastenings, supports, and methods approved by structural engineer with a safety load factor of at least 1.5. Provide installations that meet the most stringent of applicable codes and regulations to minimize potential damage to personnel and equipment from foreseeable seismic events.
2. Brace hanging audiovisual and associated equipment both to minimize sway and to prevent detachment from the overhead structure in accordance with applicable codes.
3. Firmly secure equipment in place unless requirements of portability dictate otherwise.

3.02 EXAMINATION

- A. Prior to starting the work of this section, examine areas to receive system components and pathways to receive cabling to verify conditions are ready for work of this section and to verify conformance with manufacturer and specification tolerances.
 1. Verify that pathways, including conduit, junction boxes, cable trays, ceiling enclosures, etc., are in place prior to placing cables into pathways and as required by applicable codes.
 2. Verify that rough-in (including conduit, device boxes, floor boxes, and the like) is ready to receive wiring, cabling, devices, equipment, and the like prior to installing into the rough-in.
 3. Verify that electrical power service is ready and stable prior to connecting equipment.
 4. Check ceiling types, ceiling heights, and clearances above ceilings to ensure conditions are appropriate per manufacturer's installation requirements.
- B. Verify that the network is operational and ready to receive connection from and configuration for the System. "Ready" includes settings on the network required for the System to function properly. Coordinate with the network contractor as needed to ensure the network settings have been adjusted to support full functionality of the System.
- C. Proceed with installation work only after unsatisfactory conditions are corrected.

3.03 INSTALLATION

- A. Plenum-type equipment racks / enclosures
 1. Completely assemble equipment racks / enclosures. Include parts and accessories, such as electrical power distribution devices, cable dressing accessories, and blank and vent panels, required for a complete result.
 2. Anchoring/bracing: Anchor enclosures to the underside of the slab at four points per approved structural details using anchors and methods approved by a structural engineer.
 3. Bonding/Grounding: Connect the equipment rack frame to an approved ground point using a bonding conductor (12 AWG up to 6 AWG) and approved connectors. (Here, an approved ground point may be the ground of the branch circuit serving the rack or an approved conductor to the ground bus of the electrical panel serving the rack.)
 4. Cooling provisions: Coordinate cooling provisions (means to prevent equipment from overheating) within rack/credenza/etc., such as inlet and exhaust openings, exhaust fans, etc. All of the installed equipment must be capable of working continuously with the enclosure closed normally while staying within manufacturers' operating temperature specifications. Acceptance testing will include temperature verification.
- B. Projection systems
 1. Projector Supports
 - a. Anchor poles to structure using means approved by a structural engineer.
 - b. Install lateral and/or transverse bracing to poles for seismic bracing as required.
 - c. Securely install mounts onto poles using compatible adapting components.
 2. Projectors
 - a. Securely install projectors to mounts.

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- b. Fully assemble and install projectors, lenses, and mirrors such that the final condition will be no observable movement in the image induced by motor vibration or other mechanical operations.
 - c. Install accessories onto mounts or projectors using approved attachment methods that guarantee the longevity of the installation. Accessories may be attached mechanically, if allowed by the projector/mount manufacturer, or by using 3M TB3571/3572 hook and loop fastener tape or an approved equal.
3. Align projection systems so projected images fill the viewing areas of the associated projection screens and exhibit no geometric distortion.
4. Only use physical and/or optical adjustments to correct geometric distortion.
5. Only use electronic or digital correction when called for in this document package.
6. Confirm that the total averaged light output from all projectors, in lumens, is at least 85% of that specified by the projector manufacturer.
7. Confirm that the light falloff from the center of the projected image to four corners, as measured at the projected image plane, does not exceed 50%.
- C. Loudspeaker tap settings
 1. Where loudspeaker tap wattages are specified in the design documents, set transformers per these. Otherwise, set taps per best practices.
 2. Set taps such that the total wattage of a series of loudspeakers will not exceed 75 percent of the associated amplifier's rated wattage.
 3. Record tap settings per loudspeaker for inclusion on the as-built drawings.
- D. Loudspeakers, wall recessed mounted
 1. Prior to installing loudspeakers, line niches using glass fiber loosely filled to 2 pounds per cubic foot density.
 2. Provide cabling service loops to allow loudspeakers to be removed from niches prior to disconnection.
- E. Loudspeakers, wall surface-mounted
 1. Install loudspeakers per manufacturers' recommendations and the design documents.
 2. Install loudspeakers plumb and square.
 3. Use security mounting hardware where loudspeakers will be mounted below 10' AFF.
 4. Provide security cables per codes and best practices.
 5. Where manufacturer labels are visible on loudspeaker grills and are rotatable, align these to read correctly.
 6. Where loudspeakers will be exposed to humidity or water spray, ensure water will not be able to penetrate cable connections.
- F. Loudspeakers, acoustical tile ceiling mounted
 1. Coordinate ceiling tile work (such as cutting holes) with the ceiling contractor.
 2. Unless directed otherwise, center ceiling loudspeakers to ceiling tiles and evenly space loudspeakers.
 3. Cut ceiling tiles to fit loudspeaker such that no gaps are visible after the loudspeaker cover/grille is installed.
 4. Install ceiling loudspeakers with safety wires attached to the building structure per applicable codes and best practices.
 5. Use tile rails and other support components to ensure loudspeakers do not sag.
 6. Where manufacturer labels are visible on loudspeaker grills and are rotatable, align these consistently.
 7. Replace ceiling tiles damaged during loudspeaker installation work.
- G. Loudspeakers, gypsum ('hard lid') ceiling mounted
 1. Coordinate ceiling work (such as cutting holes) with the framing contractor.
 2. Unless directed otherwise, align and evenly space loudspeakers.
 3. Cut wallboard to fit loudspeaker such that no gaps are visible after the loudspeaker cover/grille is installed.
 4. Install ceiling loudspeakers with safety wires attached to the building structure per applicable codes and best practices.

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5. Where manufacturer labels are visible on loudspeaker grills and are rotatable, align these consistently.
- H. Cabling and wiring – at racks
 1. Do not use electrical tape for bonding, splicing, joining, or any other purpose.
 2. As a general practice, run power cables, control cables, and other cables with higher voltage levels on the left side of an equipment rack as viewed from the back; run other cables with lower voltage levels on the opposite side. Where wiring issues or wire routing facilities preclude this configuration, it is acceptable to deviate from the directions above, if separation is maintained between signal and electrical power cables.
 3. To reduce signal contamination, group cables per the signals being carried. Maintain appropriate distances between cable groups, especially between high-current (power; loudspeaker) and low-current (microphone) groups. Form separate groups for the following cables/signal types:
 - a. Power
 - b. Control
 - c. Analog video
 - d. Digital audio and video
 - e. Analog microphone audio
 - f. Analog line audio
 - g. Loudspeaker audio
 - h. Radio frequency
 4. Within racks, install wires and cables with service loops. Provide sufficient cable to allow each piece of equipment to be removed from the front of the rack for servicing.
 5. At boxes or points of termination, install wires and cables with service loops. Provide sufficient cable to allow each piece of equipment to be removed and laid flat on a surface for servicing.
 6. At slide-out equipment racks, dress cables to allow racks to be extended to the maximum length of the rack slides. For slide-out rotating racks, provide sufficient cable to allow full extension and rotation.
 7. For cables that interface with racks, cabinets, consoles, or equipment modules, use screw-type terminal blocks, terminal strips, or connectors. Telephone-style punch-down blocks (e.g., 110 blocks) are not acceptable.
 8. Do not bend any cable or wire tighter than the manufacturer's minimum bend radius.
 9. Install wires and cables such that the cable exerts no strain on its termination.
 10. Label wires and cables, regardless of length, using a cable label with a unique number or letter per the instructions below under "Labeling".
 11. Cable Shield Bonding: For cables with shields, connect them using approved connectors per an approved grounding topology.
 13. Encase umbilicals connecting moveable racks and cabinets to walls and other fixed locations in braided sleeving. Where racks and cabinets are installed in view of non-technical people, coordinate sleeving colors with the Architect.
- I. Cabling and wiring – overhead distribution
 1. Use cabling appropriate to loudspeaker impedance, cabling distance, and installation conditions (such as plenum versus non-plenum).
 2. The use of electrical tape for bonding, splicing, joining, or any other purpose is prohibited.
 3. Provide cable runs between termination points that are continuous, with sheath continuity. Splices are not permitted anywhere.
 4. Place cables within designated pathways, such as cable tray, cable hangers, etc. Do not fasten cables to other building infrastructure (such as ducts, pipes, etc.), other systems (such as ceiling support wires, wall studs, etc.), or to the outside of conduits, cable trays, or other non-approved pathway systems.
 5. Protect cables from physical interference and damage during installation and termination. Install cables with no kinks or twists.
 6. Install HDBaseT cables within manufacturers' length recommendations.

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7. Comply with manufacturers' limits for pulling tension.
8. Do not use cable-pulling compounds for indoor installations.
9. Install cables within manufacturers' bend radius limits. If no minimum bend radius is given, then maintain a minimum bend radius of six times the cable diameter during and after installation.
10. Route cables under building infrastructure (such as ducts, pipes, conduits, etc.); do not route cables over building infrastructure. Install cables to provide accessibility for future service.
11. Place cables 6", minimum, away from power sources to reduce interference from EMI.
12. Connectors: Use the following connectors:

Category	Subcategory	Type	Acceptable Manufacturers				Comments
Audio	Low-level	RCA / S/PDIF	Switchcraft	Pomona			
Audio	Low-level	3.5mm TRS	Switchcraft	Neutrik	Amphenol		
Audio	Low-level	1/4" TS/TRS	Switchcraft	Neutrik	Amphenol		
Audio	Low-level	XLR	Switchcraft	Neutrik	ITT Cannon		
Audio	Low-level	Combo XLR/TRS	Neutrik				No substitutions
Audio	Low-level	TA-series (mini XLR)	Switchcraft				No substitutions
Audio	Low-level	Microdot	Lemo				
Audio	Microphone, no mute control	XLR-3	Switchcraft	Neutrik	ITT Cannon		
Audio	Microphone, with mute control	XLR-5	Switchcraft	Neutrik	ITT Cannon		
Audio	Microphone under table or desktop, no mute	R3F	Switchcraft	Neutrik	ITT Cannon		

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Category	Subcategory	Type	Acceptable Manufacturers				Comments
Audio	Microphone under table or desktop, with mute	R5F	Microphone under table or desktop, no mute				
Audio	Low or high-level	Phoenix	Phoenix Contact				
Audio	High-level	Banana	Pomona	GC Electronics			
Audio	High-level	Speakon	Neutrik	Switchcraft			
Video	50-ohm	BNC	Kings	AMP - TE Connectivity	Trompeter	Amphenol	
Video		Triax	Trompeter				
Video		HDMI bulkhead barrel	Switchcraft	Cliff	Neutrik	Harting	
Video		HDMI cable	Extron	Crestron			
Video		DisplayPort cable	Extron	Crestron			
Video		Mini DisplayPort/Thunderbolt cable	Extron	Crestron	Apple		
Video	D-sub	HD-15 ("VGA") cable	Extron	Crestron	Cables to Go		
RF	75-ohm	BNC	Kings	AMP - TE Connectivity	Trompeter	Amphenol	
RF		F-type	Belden	Amphenol	Liberty	Digicon	
RF		UHF	Amphenol				
Control	D-sub	DB-9, DB-25	Amphenol	TE Connectivity			
Control	Phoenix		Phoenix Contact				Or as provided with equipment
Control	Modular	4p4c plug	Cinch Connectivity	Molex	TE Connectivity	Hirose	
Control	Modular	8-contact	Ortronics	Panduit	Belden	Molex	
Control	USB cable	A, B, C types	Extron	Crestron	Hosa	Belkin	
Control	Crimp	Fork lug	TE Connectivity	Molex	Phoenix Contact		
Control		XLR	Switchcraft	Neutrik	ITT Cannon		
Control		DIN	CUI	Hirose			
Control	etherCON	RJ45	Neutrik				

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Fiber		FC	Molex	TE Connectivity	3M		
Fiber	opticalCON	Click-on duplex	Neutrik				

Category	Subcategory	Type	Acceptable Manufacturers				Comments
Fiber		LC Duplex	Molex	TE Connectivity	Conec		
Fiber		SC	Molex	TE Connectivity	3M		
Fiber		SC Duplex	Molex	TE Connectivity	3M		
Fiber		SMA	Industrial Fiberoptics	TE Connectivity	Phoenix Contact		
Fiber		ST	Molex	TE Connectivity	3M		
Fiber		TOSLINK	Tripp Lite				
Fiber		LC	Molex	TE Connectivity	3M		

- J. Terminations and Cords at Floor Boxes
1. Provide strain relief for cables. Use appropriate cable management products (such as hook and loop straps for UTP and STP cabling, and nylon cable ties for other cables) to group similar cable types.
 2. Provide permanent labels on cables within 6" of terminations.
 3. Provide permanent labels on receptacles within floor boxes to clearly identify terminations and services.
 4. Encase umbilicals connecting moveable racks, cabinets, etc., to floor boxes in braided sleeving. Where racks and cabinets are installed in view of non-technical people, coordinate sleeving colors with the Architect.
- K. Blank panels: Provide blank trim plates in floor, wall and furniture-mounted boxes at unused termination positions. Fill each module opening filled, either with a receptacle, a receptacle plate, or a module of the type the opening is intended to house.
- L. Patch panels
1. Assignments: Wire patch panels so that signal sources appear on the upper row of a row pair; and destinations appear on the lower row of a row pair. Submit variations from this approach per the requirements in Submittals.
 2. Designation strips: Utilize alphanumeric identifications and descriptive information on audio and video patch panel designation strips. Number the jack positions in each row sequentially from left to right. Letter the jack rows sequentially from top to bottom. Include the alphanumeric identification of each jack on the functional block drawings. Mount reproductions of these drawings in an appropriate location near the patch bays.

3.04 EDID MANAGEMENT

- A. For each system, determine the maximum pixel resolution, frame rate, and color depth supported by all content displays, and designate this as the target resolution for the system. Omit digital signage displays from this process.
1. Scalers: Configure video scalers as follows:
 - a. Input: Emulate the EDID configuration of the native resolution of the connected display or projector for both analog and digital inputs.

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- b. Output: Configure to match the native resolution of the display system and at the highest supported scan rate.
- B. Determine the system's maximum audio parameters – output channel count, LFE capabilities, etc.
- C. Configure the system's EDID management to ensure that these audio and video parameters are sent to source devices.

3.05 HDCP MANAGEMENT

- A. Include HDCP support in all equipment that incorporates copy protection for the transport of copyrighted media.
 - 1. Installation requirements
 - a. Equipment capable of passing HDCP included in this project must support the same HDCP version (i.e. HDCP 1.4 or HDCP 2.2).
 - 2. Exceptions
 - a. HDCP may be defeated for educational institution projects per 'fair use' copyright terms.

3.06 NETWORK SECURITY

- A. Leave no network-connected device operating with its factory-default password.
- B. Obtain Owner defined password changes for all network-connected devices. Program these passwords into the devices.
- C. Where available, enable two-factor authentication.

3.07 PROGRAMMING AND EQUIPMENT CONFIGURATION

- A. General Programming
 - 1. Install the most current version of manufacturers' firmware on devices.
- B. Audio Processor Programming
 - 1. The following instructions apply to all systems including programmable audio processors and microphones.
 - 2. Make equalization and other room tuning adjustments to obtain the flattest, and least colored result the system is capable of.
 - 3. After tuning the system, perform other adjustments, such as dynamics, AEC, etc.
- C. Control System and Touch Panels
 - 1. Owner's requirements
 - a. Meet with the Owner and document their functional and user interface requirements (backgrounds, color scheme, screens, menus, functions, etc.).
 - b. Develop programming and user interfaces based on the user requirements.
 - c. Submit touch panel layouts and menu flow documentation to the Owner and Engineer per submittal schedule.
 - d. Meet with the Owner and Engineer and present the control system programming and user interfaces. Obtain the Owner's approval on these items.
 - 2. Programming guidelines
 - a. Create initial screens (splash screens) that use a version of the Owner's logo, generated without visible scaling artifacts.
 - b. Only use red for alarm indicators and other screen elements of special significance.
 - c. Avoid use of technical terms, rather, use clear, everyday language. For example, instead of "System On", use "Turn System On"; instead of "Power Down", use "Turn Power Off", etc.
 - d. Ensure soft buttons are sized consistently and spaced evenly.
 - e. Ensure spelling, punctuation, and grammar are 100% correct.
 - f. Provide menus on both touch panels and control system web pages that appear and function consistently throughout the project.

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- g. Ensure items with similar functions appear consistently in all menus.
- h. Provide soft button presses that display visual feedback, and if required by the Owner, audible feedback.
- 3. Tech menu: Provide a “tech” menu for each touch panel. Include in tech menus:
 - a. Volume control for button audible feedback
 - b. Screen brightness
 - c. A means to change the tech screen password; obtain from the Owner’s Representative a default password for all touch panel tech menus
 - d. Other technician-specific functions required for each system
- 4. Make IP control system devices (touch panels, controllers, processors, etc.) accessible and controllable via the network and via web access. For example, users and/or technicians shall be able to operate touch and pushbutton panel functions remotely. Coordinate with the Owner’s Representative to ensure a successful implementation of this requirement.
- 5. In AV-equipped rooms with an operable partition, program the AV system to use signals from the rooms’ partition sensors to automate audiovisual system combine/divide functions.
- D. Power control and sequencing
 - 1. Whether explicitly listed in this specification or not, provide power control interfaces, e.g., remotely controllable PDUs, for equipment and devices that are not equipped with integrated power control. Provide power control interfaces that are fully compatible with the specified control system. Follow this directive for devices, such as audio power amplifiers, which would not be adversely affected by external power controls. Omit such power controls for devices, such as transmitters and receivers, that should not be externally power controlled.
 - 2. Configure non-controlling items to power off or go into a standby/low power-consumption mode when systems are powered off. At minimum, program the AV system to power off the following types of devices when not in use.
 - a. Audio processors
 - b. Audio amplifiers
 - c. Displays
 - d. Projectors
 - 3. Configure devices that detect connection to user devices to stay in standby/low power-consumption mode when audiovisual systems are turned off.
 - a. Video switchers and processors
 - 4. When turning systems on, use the following sequence for audio components.
 - a. Turn on source devices.
 - b. Turn on processing and routing devices.
 - c. Turn on amplifiers.
 - 5. When turning systems off, use the following sequence for audio components.
 - a. Turn off amplifiers.
 - b. Turn off processing and routing devices.
 - c. Turn off source devices.

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- E. Network connection
 - 1. Connect all network-connectable equipment and devices to the network. Program them to electronically issue notifications for preventative maintenance (e.g., replace a projector lamp).
 - 2. Coordinate with the Owner's Representative which devices are to provide notification (e.g., email notification) immediately at the time of a fault and which devices will provide notifications on a daily or weekly report.
 - 3. Coordinate with the Owner's Representative to obtain the default notification means (e.g., the email address for maintenance messages).
 - 4. Ensure the Owner's Representative can revise the maintenance email address via a simple method using a single address for all networked AV devices. Document this procedure in the Operations Manual.
- F. Equipment configuration:
 - 1. Blu-ray disk players: Set color space to RGB.
 - 2. Computer interfaces, signal extenders and transmitters with integral input switching: Program each device and related system components involved so that the analog audio input is active regardless of which video input is selected.

3.08 LABELING

- A. Provide labeling identifiers that match closeout documentation (e.g., as-built drawings, O&M Manual, etc.).
- B. Clean and degrease surfaces receiving nameplates and labels prior to affixing labels.
- C. When creating labels for user-facing equipment and cables, use colored labels where possible. Example uses are floor boxes, table boxes, cameras, displays, and user-facing cables. Use color coding to relate labels to related components, i.e., match the text and color on each user-facing cable, its corresponding button on the button panel, and its corresponding input on the display. Example: HDMI 2 cable has a yellow label printed with "HDMI 2", the button panel at the table box has a yellow "HDMI 2" label and the input on the display has a yellow label printed with "HDMI 2".
- D. Interface plate designation
 - 1. Provide wall-mounted interface plates with clearly engraved alphanumeric identification of input type (e.g., "MIC-1", "LINE IN", "SPEAKER", "VIDEO", etc.) and corresponding patch field designation.
- E. Equipment enclosures
 - 1. Install the label on the top of the rack or cabinet, centered horizontally.
 - 2. Example: line 1: "AV-01", line 2: "Audiovisual Devices".
- F. Equipment
 - 1. Rack-mounted equipment: Install labels in visible locations on equipment and devices on the front and back of the equipment.
 - 2. Field equipment: Install labels in visible locations on miscellaneous field equipment and devices.
- G. Wireless transmitters and receivers
 - 1. Label wireless transmitters and receivers so users can clearly identify a given transmitter associated with its receiver.
 - 2. Use an identifier, such as a room number, that associates each transmitter with a given room or system.
 - 3. Example: RM.230–MIC.3–RCVR.1
- H. Wire and cable
 - 1. Comply with the Owner's labeling requirements. If the Owner does not have labeling requirements, conform with InfoComm F501.01.
 - 2. Provide labels with machine-generated text; hand-written labels will not be accepted.
 - 3. Provide labels with black text 1/8" high or #12 font size.

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4. Generate a unique identifier for each cable and wire using the system defined in the InfoComm F501.01 standard. Include "primary level" data elements (per F501.01); "secondary level" (per F501.01) data elements are optional.
5. Install labels on both ends of cables no more than 4" from the edge of the cable. Install labels such that they are visible by a technician from a normal stance.
- I. Patch panels
 1. Using two-line designations, indicate groups of outputs on upper rows of top ports and inputs on lower rows of bottom ports.
 2. Example: line 1, "Mixer Mic Inputs"; line 2, "In-1 | In-2 | In-3 | In-4, etc."
- J. Batteries
 1. Label batteries with the month and year they were installed.
 2. Example: "Installed April 2017"

3.09 FIELD QUALITY CONTROL

- A. Initial tests and measurements: Prior to final adjustment and scheduling acceptance testing, perform initial tests and measurements. At minimum, include the following initial tests and measurements:
 1. Adjust, balance, and align equipment for optimum quality and to meet manufacturers' published specifications.
 2. Perform the test procedure provided at the end of this specification and return the completed form no less than one week prior to the initial punch walk.
 3. For rack-mounted equipment with user-accessible controls, install 1/8" diameter vinyl "map dots" as indicators for nominal operating positions of rotary, slider, and other accessible controls. Provide multiple dots, adequately distinguished, for controls having more than one nominal operating position.
- B. Twisted-pair cable testing: Follow the following procedures to test CATEGORY-type twisted pair cabling.
 1. Equipment, or equal:
 - a. Fluke DSX CableAnalyzer
 2. Test procedure:
 - a. Configure the cabling and test set up as a permanent link.
 - b. Test each cable under a TIA-568 Permanent Link test script to match the category of the installed cabling.
- C. Digital video cabling: Follow the following procedure to test each provided digital video cable.
 1. HDMI: Quantum Data 780, or equal
 2. DVI/SDI/HD-SDI: Quantum Data 882D, or equal
 3. DisplayPort: Quantum Data 882E-DP, or equal
 4. Test Procedure:
 - a. Test each cable.
 - b. Replace all cables that fail.
- D. Audio system:
 1. Loudspeaker line impedance: Measure the impedance at 63 Hz, 250 Hz, and 1 kHz and the resistance of each loudspeaker line leaving the sound equipment rack with the line disconnected from its normal driving source. For lines to full range distributed loudspeaker systems, measure impedance at 1 kHz.
 2. Hum and noise level:
 - a. Measure the hum and noise levels of the overall system for each microphone input channel and line level input channel.
 - b. Adjust gain controls for optimum signal to noise ratio so that full amplifier output is achieved with 0 dBm at a line level input.
 - c. Terminate line level inputs with resistors of 150 and 600 ohms, respectively, for these measurements.
 - d. Disconnect the loudspeaker lines and terminate the power amplifier outputs with power resistors for these measurements. Use load resistors within 5% of the nominal load

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- impedance of the amplifier under test. Use resistors with power ratings equal to or greater than the power rating of the amplifiers.
3. System frequency response:
 - a. Measure audio system frequency response for the AV systems described in Part 1. Adjust systems to provide specified performance.
 4. Uniformity of coverage:
 - a. Using a calibrated testing device, measure octave bands using a pink noise test signal played through the loudspeaker system(s).
 5. System power output and signal level adjustment:
 - a. Measure the electrical distortion of the overall system for each line level input channel.
 - b. Adjust gain control as for the tests specified herein.
 - c. Apply a 1 kHz sine wave signal from a test signal generator having less than 0.5% total harmonic distortion at the input tested, at a level required to produce full amplifier output. Note that a pad with 150-ohm output impedance is required for driving the microphone level input in accordance with the EIA standard.
 - d. Use a distortion analyzer to measure the output level and total harmonic distortion of the audio equipment. In the absence of a distortion analyzer, a high input-impedance measuring device such as a DMM may be used to measure the output level.
 6. Loudspeaker polarity
 - a. Perform loudspeaker line polarity checks using a polarity tester or use DC source at one end of each line and a voltmeter at the other end. Confirm that loudspeaker lines are correctly polarized with respect to color coding.
 - b. Confirm loudspeaker polarity using a polarity tester.
 7. Freedom from parasitic oscillation and radio frequency pickup:
 - a. With systems set up for each mode of operation specified in the Part 1, confirm that systems are free from spurious oscillation and radio frequency pickup, in the absence of audio input signal and when the system is driven to full output at 100 Hz.
 - b. Confirm these tests audibly and by using an oscilloscope having at least 5 MHz bandwidth.
 - c. Apply a slow sine wave sweep from 50 Hz to 5 kHz at a level of 6 dB below rated power amplifier output to each system. Listen carefully for buzzes, rattles and objectionable distortion.
 - d. Correct causes of these defects unless the cause is clearly from other than the sound amplification system's equipment and installation, in which case bring the cause to the attention of the Owner and Architect.
 8. Audio test signal paths: Verify operation from source inputs through system components to signal destinations.
- E. Analog composite video system:
1. Signal to noise: Operate the system using an RS-170A test signal. Measure and document output noise levels using a composite video distortion analyzer.
 2. Differential gain: Using an RS-170A step test signal and a waveform monitor, measure chrominance, luminance, and normal synchronizing and blanking signals. Measure variations in chroma subcarrier amplitude at 10%, 50%, and 90% luminance.
 3. Differential phase: Operate the system as indicated above and measure chroma subcarrier phase variations at 10%, 50%, and 90% luminance.
- F. Projection systems:
1. For each projection system, measure light intensity at the screen's center and four corners. Take corner measurements 5% of the image area width and height in from image edges.
 2. Use a properly calibrated foot-candle (or lux) meter with cosine correction for the above measurements.
- G. Control systems:
1. Verify all operational functions at each fixed control interface position.
 2. Verify all operational functions of provided wireless control devices.
 3. Verify all operational functions of the control system and interfaced devices.

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H. Radio frequency (RF) systems:

1. Connect an analog-capable TV to each system outlet. Make a subjective evaluation of picture quality and verify that no visible components of cross modulation, ghosting, or beat interference appear when the receiver is tuned to each of the desired channels.
2. Using an RF signal strength meter, record the signal levels in dBmV of modulated carriers transmitted through the system at representative outlets.
3. RF Test Signal Paths: Verify proper system operation from source inputs to the head end, including antennas, CATV feeds and modulators, through line amplifiers, splitters, and directional couplers, to system outlets.

3.10 CLEANING, PROTECTION AND REPAIR

- A. Remove temporary coverings and protection of adjacent work areas. Remove unused, excess, and left over products, debris, spills, or other excess materials. Remove installation equipment.
- B. Leave finished work and adjacent surfaces in neat, clean condition with no evidence of damage.
- C. Repair or replace damaged installed products.
- D. Legally dispose of debris.
- E. Clean installed products in accordance with manufacturer's instructions prior to Owner's, or Owner's Representative's, punch walk.
- F. During the installation and up to the date of final acceptance, protect finished and unfinished work against damage and loss. In the event of such damage or loss, replace or repair such damaged work.

3.11 SUBCONTRACTOR MANAGEMENT

- A. Continuously supervise subcontractors during the installation; intermittent supervision is not acceptable.

3.12 SYSTEM ACCEPTANCE TESTS

- A. Perform system acceptance tests after completion of initial system checkout and after submitting the Initial Testing and Tuning Report.
- B. Prior to setting up a demonstration and/or punch walk with the Engineer, ensure that the System/Systems are complete, operational, and fully functioning, and that pre-functional and functional testing have been completed. Fees for any additional punch walks resulting from incomplete and/or non-functioning Systems may be assessed.
- C. System acceptance tests consist of the following:
 1. Take a physical inventory of equipment on site and compare it to equipment lists in the contract documents.
 2. Demonstrate the operation of system equipment.
 3. Perform both subjective and objective tests to determine compliance with the specifications. Provide test equipment specified for these tests.
 4. Provide final, "as built" drawings, run sheets, manuals, and other required documents, as detailed in Part 1.
 5. Provide complete testing reports generated by subsystems that provide self-testing.
 6. Perform power on/off cycles to ensure these take place with no audible and only minimally visible artifacts, pops, etc.
- D. Initial Testing and Tuning Report
 1. Perform the following tests for each system unless otherwise noted in Part 1.
 2. Use additional pages as necessary to allow complete comments.
 3. Where blanks are provided in the checklist below, observe the associated value in parenthesis.

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1	Record equipment that was specified but is not present. Provide a reason why this equipment is not present.		
2	Confirm no sharp or jagged surfaces are accessible to users and technicians.		
3	Confirm that each active device's external temperature, measured using a non-contact thermometer, is within manufacturer's guidelines.		
Test	Description	Result	Comment
4	Perform and log cable inspection. Confirm each cable is labeled, dressed, included in a bundle with cables with like signals, not under stress, is serviceable, is correctly strain-relieved, is not bent beyond manufacturer's recommended bend radius, does not have tie wraps tensioned excessively or used inappropriately. Confirm labels are positioned and oriented consistently and are legible and unambiguous.		
5	Demonstrate that the full inventory is new equipment, in full compliance with the specification, or as modified by approved submission. Record test results as pass/fail, and list exceptions.		
6	Confirm rack elevation and single-line drawings, cable and other labels and engravings are an accurate model of the furnished system, and comply with latest revised specifications. Record test results as pass/fail.		
7	Confirm switcher inputs and outputs are labeled (wherever possible), so that users can easily make manual routes quickly without having to refer to the system drawings.		
8	Confirm amplifier channels are properly labeled, so technicians can make quick adjustments without having to refer to the system drawings.		
9	Confirm rack mounted equipment is labeled and that the labels match those on the drawings (equipment symbols and/or description), control system, field plates, patch panels, and any labels associated with the system.		
10	Confirm modular terminations are solid in their connectors.		
11	Confirm each coax cable respects the manufacturer's minimum bend radius or at least 5x the cable's diameter.		

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13	Confirm power amplifiers are working within rated load. <i>Record the impedance (and at what frequency) of each loudspeaker line on each power amplifier at 63, 250, and 1,000 Hz.</i>		
14	Using appropriate test signals, have the sound system produce a nominal operating level of (65) dB SPL for conference speech, (60) dB SPL for program material, "A" weighted at all listeners' ears \pm (2) dB ("Uniformity of Coverage") (or at least (15) dB above the ambient noise, A-weighted, whichever is greater), with the control system volume control indicating "normal" or default setting. <i>Record results for each channel and source.</i>		
Test	Description	Result	Comment
15	Confirm the system is capable of producing an additional (15) dB above this level ((80) dB SPL) for each audio source, with less than 0.5% THD (Total Harmonic Distortion) plus noise. <i>Measure THD plus noise when source is at (15) dB above nominal operating level at each "destination", for all sources selected.</i>		
16	Confirm the system develops a noise level that is electrically (55) dB below the normal operating level for all audio sources. "Noise" refers to the aggregate of hum, electrostatic noise, RF interference, etc. <i>Measure and record Signal to Noise ("signal" measured electrically at nominal operating level at each destination, for all sources selected.</i>		
17	Confirm program loudspeakers are connected in the same polarity, and speech reinforcement systems are polarized such that a positive acoustic pressure on a microphone results in a positive acoustic pressure at the loudspeaker ("Polarity Test").		
18	Confirm the system produces no more than a (1) dB variance in program source levels when each program source is playing audio from a calibrated medium (CD, test signal generator, etc.)		
19	Confirm there is no audible vibration caused by improper mechanical installation. <i>Use a continuous sweep signal at headroom level (from an audio test signal generator or test CD.) Provide a pass/ fail result and document which device fails and the frequency of these artifacts. ("Buzzes and Rattles Test").</i>		

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23	Confirm equalizers, whether hardware or virtual, are adjusted for best intelligibility, and in accordance with any preferred acoustic level response curves. <i>Record the "house curve" before equalization, as well as after the equalizers have been tuned, with and without microphone input filters. If requested by the Consultant, produce this documentation for systems without equalizers, as this test may apply to the preamp filter settings in cases where intelligibility can be improved.</i>		
24	If required, confirm system intelligibility, with a RSTI (Rapid Speech Transmission Index) greater than 0.85.		
28	Where several displays are visible in the same space, confirm picture tonal consistency across all of them. For composite video signals, use NTSC color bars with PLUGE signal to all. For digital video signals use a colorimeter and test color signal software to confirm consistent images		
Test	Description	Result	Comment
29	Confirm projectors are focused, centered, and evenly illuminated. <i>If requested, confirm using a calibrated light meter that the brightest measurement locations are no more than +10% above average, and the dimmest locations no less than – 5% below average measurement. If requested, document that geometric distortion is within 2% tolerance. Take actual measurements if necessary (top, bottom, left, right dimensions of white portion of screen) and photograph if necessary.</i>		
30	Confirm that the system displays with stability, and with no scaling-related visual artifacts when switching between, at a minimum, the resolutions specified in 1.04 D. Record test results.		
31	Where HDMI, DVI, or DisplayPort signals are included in the system, confirm that an acceptable signal is being displayed on the monitor from each source position. Use the Alt Pixel test image (pixel-on, pixel-off) for each resolution included in the design intent: 1,920x1,200@60, 1,920x1,080@60, 1,280x720@60, as required. Inspect each, leaving the signal on for three minutes. Confirm that no artifacts are visible. For systems including 4k displays, test also at 3,840 x 2,160 and 4,096 x 2,160. Note: If the signal is going to a codec, disable HDCP. If the signal is going to a display, enable HDCP unless specified otherwise in Part 1.		

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32	Using a signal generator, confirm scaler and display/projector configurations by successfully passing video at the resolutions defined in 1.04 D.		
33	Confirm HDCP is maintained from sources to destinations except as excluded above. Confirm EDID is managed correctly and that devices output at resolutions supported by the system.		
34	Confirm the control system controls all of the required equipment as specified. Confirm system performs with stability and in sync with the equipment being controlled without the need to reset any item of equipment. Confirm that user interface requirements dictated in Part 3 of the audiovisual specifications have been met.		
Test	Description	Result	Comment
35	Confirm system is serviceable: all devices must be easily removable for repair by one person; all cables must be dressed neatly and be provided with adequate services looks, must be bundled in forms (refer to "Sound System Engineering", Davis and Davis, 1987 and "Audio Systems Design and Installation", Giddings, 1990) having no excessive pressure on cables at termination points and connectors, and each cable number must agree with the shop drawings and cabling run list.		
36	Confirm switches and receptacles are logically and permanently labeled.		
37	Confirm nomenclature for consistency: drawings, touch screen, wall plates, floor boxes, patch panels, equipment, etc.		
38	Confirm patch cables have cable numbers.		
41	Confirm TV reception from all sources (OTA, CATV, etc.) and that all channel presets are accurate.		
43	Confirm and document the IP configuration information provided by the Owner is loaded into the equipment, including IP and MAC addresses, Dante device names, subnet masks, gateways, time server, gatekeeper, etc. Confirm that all network functions specified by the customer function properly on the customer's LAN.		
44	Confirm all web-based system control and monitoring features, and other IP system functionality (time servers, system-generated e-mail, etc.) are completely functional.		
45	Confirm that display devices have On-Screen Displays/Menus disabled. If the customer has directed otherwise, document from which person this direction came.		

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46	Confirm that video projectors have blue screens or other images or colors displayed in the absence of an input signal disabled. If the customer has directed otherwise, document from which person this direction came.		
47	Log test conference calls (audio and video). Include in the log start time, line used, number called, status of connection (completed/failed, etc.) who was spoken with at the far end, success of full duplex, success of auto-disconnect, dB SPL in the room. Note static, jitter/packet loss, or any other artifacts, distortion, etc. Note if auto-disconnect functions as specified.		

- E. If further adjustment is required, or defective equipment must be repaired or replaced, tests may be suspended or continued at the option of the Owner or Owner's representative.
1. If the need for further adjustments becomes evident during the demonstration and testing, continue work until the installation operates properly. Included in the continued work, changes to or installation of resistive pads, adjustment of loudspeaker aiming, adjustment of system processing, programming changes to the control system, convergence and/or alignment of the video projector, if these adjustments are required.
 2. If acceptance of the system is delayed because of defective equipment or because the equipment does not fulfill this specification, reimburse the Owner for time and expenses for these tests during extensions of the acceptance testing period.

3.13 OWNER TRAINING

- A. Provide a minimum of 8 hours per instructor group and a minimum of 4 hours per IT staff group of training on the audiovisual systems specified herein at the project site (or other location designated by the Owner) by a qualified instructor (equipment manufacturer as needed) covering operation and maintenance of the systems. Training for the IT staff should be of technical nature, while training for the instructor group should be of operational nature.

3.14 MAINTENANCE AND EXTENDED SERVICE

- A. Warranty Maintenance
1. On a quarterly basis during the warranty period, execute a service visit to check and adjust equipment and systems such that they maintain the original performance. Coordinate visits directly with the Owner.
 2. Pre-emptive maintenance minimum requirements:
 - a. Clean filters, vents, and lenses, and dust the equipment.
 - b. Verify projector images fill screens appropriately and images are focused.
 - c. Test and verify that all system controls operate as labelled and that the controlled devices respond accordingly.
 - d. Document and photograph any conditions that may affect the continued function and long-term operation of the audiovisual system and report to owner.
 - e. Document and report projector lamp life to the Owner and replace lamps as directed.
- B. Provide cost for additional service levels beyond the warranty period (as defined in this section) as follows:
1. One year, three-year, and five-year service with quarterly pre-emptive maintenance calls and 24- hour issue response
- C. Touch Panel Programming Updates
1. At a date determined by the Owner within six months following Substantial Completion, attend a single meeting with them regarding alterations or updates to the touch panel

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layouts or function. At a time approved by the Owner, implement those alterations or updates.

2. Provide any training necessitated by these revisions.
3. Provide documentation of these revisions to the Engineer.
4. Provide the source code documentation according to "Software License" in this section.

END OF SECTION

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SECTION 27 51 16 - PUBLIC ADDRESS AND INTERCOMMUNICATION SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Principal items of Work in this Section include but are not limited to:
- B. Centralized racks, as indicated on the Drawings, containing a fully operational public address (PA) system, intercommunication system, and UPS. Features required include all-call paging, zone paging, class-tone activation, intercom access to individual speakers, phone to phone communications, radio and CD audio distribution, and classroom phone outside line access to 911. These features are accessible from the PBX, main PA phone, classroom phone or audio microphone. System shall also provide for interfacing with a master clock system for a class change signaling system, and with a Fire Alarm system for override of the tone signaling, PA audio, or both.
- C. Conductors, conduits, and terminal strips, including interface cabling to PBX system, autonomous system overrides, Master Clock system and the Fire Alarm system.
- D. Provide labor, engineering, design, testing, materials, supervision, tools, mounting hardware, cable management, software and components to provide a complete operable installation. The system shall be installed in compliance with project documents, applicable codes, manufacturer's published recommendations, and industry standards to deliver a system that meets standards of quality and functionality.
- E. Provide services on Project site including specified connectivity for administration areas, classrooms, computer laboratories, libraries, auditoriums, multipurpose rooms, P.E. areas, quad area, other instructional areas, and work areas as indicated in Project Drawings.
- F. Acronyms:
 - 1. DTMF Dual Tone Multiple Frequency
 - 2. IC Intercom
 - 3. LCD Liquid Crystal Display
 - 4. OAR Owner Authorized Representative
 - 5. PA Public Address
 - 6. PBX Private Branch Exchange
 - 7. VFD Vacuum Fluorescent Display
 - 8. LED Light Emitting Diode
 - 9. SLC Small Learning Community

1.02 SYSTEM REQUIREMENTS

- A. Intercommunication System: System shall be a combined public address and intercommunication system with UPS.
- B. Communication hardware shall be furnished with the capacity for internal communication between operator and selected classrooms. Normal and emergency alerts from classroom telephones to the main office shall be annunciated by an alerting tone, appear on a wall-mounted administrative display located where most office staff can view at the same time, and identify the calling room's extension. These alerts shall function as described by the manufacturer. Calls

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shall be displayed in the order in which they are received, and the additional calls stored in memory. The main operator shall be able to answer calls in sequence or out of sequence. Caution office staff during training about using any que-clearing commands without verifying the nature of each call. Dialed calls to classroom phones are initiated by ringing the classroom telephone. These phones shall have their ringer volume control locked in the maximum ring volume position. Dialed intercom calls to the classroom speaker are preannounced by an alert tone and repetitively beep during the connection. If the classroom handset is lifted from its cradle and the conversation shall automatically transfer from the speaker to the classroom phone. Predetermination as to whether to ring the telephone or to permit talking over the speaker shall be user selectable when dialing. Signal switching for communication operations shall be accomplished by electronic methods.

1. Direct Dial Telephones: A direct-dial telephone system with electronic switching shall be furnished to accomplish the above description. The system control circuit shall be state-of-the-art design with modular plug-in printed circuit construction and advanced type technical mechanism. The central switching exchange shall utilize standard DTMF signaling for conformance with standard telephone practices.
2. Administrative Telephones: Administrative telephone communication system shall provide the following minimum requirements:
 - a. Administrative control center shall be a standard push-button dialing telephone complete with solid state pre-tuned tone oscillators identical to those employed by public telephone companies.
 - b. Central switching exchange shall be of the modular plug-in printed circuit board type, solid state sensing and logic, and shall also provide two-wire balance transmission complete with dial tone, automatic ringing and busy signal facilities.
 - c. Central switching exchange shall be furnished with facilities for a minimum of 8 unrestricted, simultaneous, private telephone conversations between:
 - 1) Administrative and administrative telephones
 - 2) Administrative and staff telephones
 - 3) Staff and staff telephones.
 - d. Capability as provided for direct dialing, private, two-way telephone communication between locations furnished with administrative telephone and staff telephone shall be provided.
 - e. Capability as provided for any administrative telephone to transfer a call from another administrative telephone or any staff (classroom) telephones to any other telephone.
 - f. Capabilities, as provided for the instantaneous distribution of emergency announcements simultaneously to all locations furnished with loudspeakers, by dialing a pre-determined code number.
 - g. Provisions for restricting access to the emergency announcements to certain administrative telephone. This shall be accomplished by the use of an authorized administrative telephone.
 - h. Capabilities as provided for the origination of both normal and priority emergency calls from any staff station location shall be provided. Priority emergency calls shall take precedence over normal calls.
 - i. Facilities as provided for answering calls registered in the readout by pressing a single response button.
 - j. Provisions for instantaneous distribution of announcements to prescheduled groups of speakers from any location equipped with an administrative telephone.

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- k. Provide an all-cancel function from an administrative telephone to cancel all classroom annunciated calls. Note: During training session, caution users to verify the nature of each call-in before clearing the que.
 - l. Local diagnostic functions shall be provided to simplify maintenance.
 - m. The system shall incorporate non-volatile memory for programs, which shall not be affected by the loss of line voltage.
 - n. Central switch shall be designed to fit in any standard 19-inch rack-mounting. It shall be possible to remove individual circuit boards from the system for inspection and service without disturbing or disconnecting any exchange wiring. Analog PA shall remain operational when circuit boards are removed. Reasonable exceptions are permitted in the design phase (base effort).
 - o. DTMF programming: Administrative telephone shall be able to distribute announcements to each individual speaker or (intercom), zone page a group of speakers, or distribute all-call.
 - p. Audio level of the telephone intercommunication system shall be attained at sound levels sufficient to override typical ambient school noise levels and to provide for a satisfactory and serviceable system with a minimum of 70 dB isolation between PA and intercommunication signals.
 - q. Upon notification from the Contractor, the OAR shall contact the Telecommunications Branch to arrange for ordering of necessary additions to the voice system to coincide with the completion of the installation of the PA or Intercom system. Any work to the PBX system will be provided by the Owner to encompass both hardware or software additions and any necessary programming and is outside of the scope of this specification. The Telecommunications Branch will manage connections to the PBX voice system. Any vendor working on the telecommunications system must be pre-approved by the Telecommunications Branch prior to any work commencing.
- C. Public Address: Public address system reproduction shall provide the following minimum requirements:
- 1. Reproduction of speech shall be clear, high fidelity and with frequencies within range of system faithfully reproduced with no detectable noise, hum or distortion. The signal to noise ratio for the frequency range of 30 Hz to 20 kHz shall be a minimum of 90 dB.
 - 2. Reproduction shall be attained at sound levels sufficient to override noise levels typical for schools, to provide a thoroughly satisfactory and serviceable system with a minimum of 30 dB signal-to-noise ratio between public address program and background noise level of 65 to 70 dB.

1.03 SUBMITTALS

- A. Provide the following submittals:
- B. Material list: Submit a complete material list for the materials and products of this section. Each submittal shall be bound and shall contain an index organized vertically by assembly and item number and horizontally by columns. The first assembly shall be the major head end equipment. The leftmost column shall be the item number; next shall be the description, followed by the applicable specification section number, followed by the specified item, which is followed by the submitted item. The rightmost column shall be for notes, which shall be used to reference the reason for submitting items other than as specified.
- C. Product Data: Include Product Data sheets or catalog cut sheets for items listed in index. Data shall be clearly marked and noted to identify specific ranges, model numbers, sizes, and other

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pertinent data. Items shall be arranged in the same order as the index and if more than one item is indicated, the submitted items shall be highlighted or marked with an arrow. Product Data shall be sufficiently detailed to allow the Architect to review the product and to allow other trades to provide necessary coordination.

- D. Include in the Product Data list submission, copies of manufacturer certificates that the Contractor is an authorized distributor of the submitted manufacturer's products; and each member of the installation crew has been trained and certified in the installation of those products. Contractor shall submit proof that his or her company has a service organization capable of responding within 24 hours of receipt of written notification and resolution within one day.
- E. Contractor shall have completed at least five projects of equal scope to systems described herein and shall have been in the business of supplying and installing specified type of systems for at least five years.
- F. Provide a letter from the Manufacturer assuring the availability of spare parts common to proposed system for a period no less than five years on components.
- G. Shop Drawings: Shop Drawings shall indicate the following:
 1. Drawn to scale, details of racks, consoles and cabinets with designations, elevations, dimensions, doors, barriers, mounting details, catalog number of locks, finishes and color. Provide a dimensioned detail of console nameplate including school name, address, and power load. Indicate manufacturer's part numbers for controls, switches, connectors and indicators. Provide a complete set of drawings of wiring diagram for each rack, instrument wiring and schematic diagrams of circuits of equipment.
 2. Detailed drawings as to interfaces with equipment furnished by others including number of wires, termination requirements, input or output voltages, input or output signals and other required coordination items, items including point to point connection details for devices and equipment,
 3. Provide a terminal block layout for the main public address terminal cabinet indicating the locations of terminal blocks for cables from the field, the public address rack, PBX, and as otherwise required. Indicate the typical lay down for each cable type and the number of blocks and space required. Include a front elevation indicating cabinet dimensions, make, location and capacity of equipment, size of gutters, type of mounting, finish, and catalog number of locks. General layout of internal devices, wiring drawings with wire numbers and device connections, vendor cut sheets of devices in enclosure and bill of materials listing description, manufacturer, part number, and quantity of items shall be included. Indicate terminal cabinet layouts for remote terminal cabinets as required.
 4. Power load of public address system and UPS operational time calculations shall be separately calculated and included with Shop Drawing submittal. Provide cabling and conduit from rack-mounted UPS to one of the MDF cabinets. Notify OAR to contact ITD for SNMP connection from the UPS to the network when system is ready.
- H. Shop drawings shall indicate equipment locations, wiring and schematics, details, panel configurations, sizes and a point-to-point wiring diagram of circuits. Shop drawings shall indicate interfaces to equipment furnished by others, identifying numbers of wires, termination requirements, input or output voltages, input or output signals and other pertinent details. Responsibility for each end of interfaces shall be noted on shop drawings.
- I. Submit Drawings prepared, signed, and sealed by structural engineer licensed in the State of California. Details shall be provided indicating the proposed means of support and attachment of wall and floor mounted racks. Calculations shall be based on the maximum load rating of the

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cabinet by the manufacturer per CBC seismic environment requirements, not the weight at time of occupancy.

1. Provide Shop Drawings, in the same size as the Record Drawings. Shop Drawings shall be prepared in the latest version of AutoCad with three electronic copies submitted along with one set of full-sized Shop Drawings.
- J. Installation and coordination drawings for items in other sections shall be included with submittal of Shop Drawings. Submit blue line copies and one reproducible copy of installation and coordination drawings.
- K. Sample Materials: Provide samples of material and equipment as required by the Architect. If samples are requested, they shall be submitted within ten days from the date of request.

1.04 CODES AND STANDARDS

- A. Complete installation shall meet or exceed the latest edition of following standards.
- B. EIA/TIA-568: Commercial building telecommunications wiring standard.
- C. EIA/TIA-569: Commercial building standard for telecommunications pathways and spaces.
- D. EIA/TIA-606: Administration standard for telecommunications infrastructure of commercial buildings.
- E. EIA/TIA-607: Commercial building grounding and bonding requirements for telecommunications.
- F. CCR Part 2 - California Building Code (CBC)
- G. CCR Part 3 - California Electrical Code. (CEC)
- H. ANSI, ASTM, UL, NEMA, IEEE and FCC standards as applicable.
- I. BICSI Telecommunications Distribution Methods Manual, current edition.

1.05 SYSTEM DESCRIPTION

- A. The Public Address or Intercommunications system shall be comprised of two separate inter-operating systems which shall provide redundant means of performing an all-call public address function and class tone distribution. Besides all-call and telephone functions, only the software-programmable system provides zone paging, zoned class-change tone distribution, two-way loudspeaker intercommunication, AM/FM radio-CD audio distribution and tone choices. The analog PA system only provides an emergency all-speaker public address from a main office microphone with feedback elimination circuitry, and an all-speaker class tone distribution activated by a service switch. Both public addresses systems shall be furnished with totally separate active electronic components. It shall be possible to remove power from components in one system while retaining the functionality of the other system. Both systems shall share a common, rack-mounted UPS with a SNMP, centrally monitored, network connection. Systems not providing public address and class tone distribution redundancy are not permitted.
- B. As a minimum a two hundred and fifty (250) watt public address amplifier shall be provided for the analog PA system. The total wattage load of all the speakers in the system shall be measured to determine if additional two hundred and fifty (250) watts or higher wattage public address amplifiers are needed. The spare wattage capacity for each public address system amplifier shall be a minimum of 33 percent of the total wattage load for each amplifier at the time of occupancy.
 1. Provide antifeedback circuitry or rack mounted feedback eliminator in PA rack. No feedback shall be detected from the fixed volume, always-hot microphone.
 2. Combine networks shall be used to convert stereo auxiliary inputs unless the dual input aux input of a preamp module provides this.

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3. A microphone shall be installed in the main office in a lockable fold-up wall cabinet which also contains an Am/Fm/single CD player. This microphone shall be "always hot" – activating a microphone switch will connect it directly to the analog public address system, permitting an emergency all-call announcement to be performed. A volume control for this microphone may be provided only if the minimum setting is still audible.
 4. A public address administrative telephone shall also be installed in the main the office, in each SLC, and in each Academy on the school site and terminate in the PA rack. Each shall use power originating from the PA UPS so they will be operational during a building power outage. The paging trunk outputs from the PBX shall be connected to unassigned phone ports of the programmable PA system, with PA ports programmed high enough for all-call, and labeled.
- C. Program-All distribution through all loudspeakers, outdoor speakers, auditorium system speakers, gymnasium speakers, and multi-purpose room speakers through a relay control. Program-All shall furnish full priority over switching between amplifier and speakers of central control system, except as specified. Program-All shall obtain signal sources as selected.
1. For each autonomous system, a selector switch on the custom control panel shall be provided to automatically override autonomous system speakers.
 2. Automatic class change signaling system shall include manual controls to select program and to do all call. A panel mounted in the P.A. rack shall include at a minimum a selector switch to provide selection of three programs and a separate switch to do all call. The number of class change signaling systems shall be determined by the number of small learning communities or other academies at the site. The Public Address and Intercommunication system shall be able to support as many class changes signaling needed, by providing a custom panel which can provide additional signal zones and tones. The design shall include the use of additional signal generators in order to provide different tone signals and the selection of three programs and a separate switch to do all call for each of the additional Learning Communities or other academies. The class change signaling selector switches shall be wired to the clock program controller for selection of one of three programs for each independent Learning Community or Academy. The selected program shall be distributed over the microprocessor based loud speaking intercom and P.A. system. At school sites where there are no independent Learning Communities or Academies, and a master clock remote input panel zone selector has been installed, typically in the main office, the automatic class change signaling system control on the PA rack shall be bypassed.
 - a. In Middle and High schools, the class change signaling system shall be programmed to include dressing and cleanup tones for gymnasiums and shop zones.
- D. In Middle and High schools, the master clock will transmit three contact closures from three separate relays per schedule. The other system shall be a microprocessor based, DTMF tone controlled modular loud speaking intercom and public address system. The intercommunication system shall provide communication between classroom telephones, speakers, administrative phones and PABX system and shall operate in conjunction with Public Address equipment. The system shall provide the following features and capabilities:
- E. The system shall be available in a rack mounted card cage configuration with a printed circuit backplane or a card shelf with a modular shelf assembly with through plug-in circuit cards. The processor card, speaker control cards, telephone control cards and PBX telephone interface cards shall plug into card connectors on the backplane or into a modular shelf assembly with through plug-in circuit cards.

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1. Speaker cards shall be installed in card cages or card shelves. Each speaker or telephone card can control sixteen or twenty-four speaker circuits depending on the system. Provide speaker and telephone cards for each switch bank as needed.
 2. DTMF tone capable cards shall be installed in any one-card cage or modular shelf. Each card can control sixteen to twenty-four call stations, DTMF telephones or display phones in any combination. Provide one station card for the first switch bank to allow connection of the system control display phone. Provide additional station cards for emergency call buttons or phones.
 3. One relay card or more per switch bank and one or more analog cards are required on switch bank. These relay cards are connected to the printed circuit backplane directly or with ribbon cables. The relays in the relay card allow the system to seize control of speakers and station circuits as required. Control voltage to the relays may be interrupted to drop out system functions and give the intercom or program control panel and associated equipment priority. The relay card is the only item common to both systems. It contains no active circuitry. Each relay card has provisions for attachment of an external power amplifier if required.
- F. A power or program panel shall be provided to supply the manufacturer's specified power for the analog speaker cards, telephone cards and for other components in the system. The power supply of the DTMF controlled system shall be independent of the switch bank based Public Address and Intercom System. It shall also be provided with a three-channel auxiliary program input chassis into which three modules of various types may be installed. These modules shall include microphone pre-amplifiers, transformer couples line pre-amplifiers, microphone, and telephone paging modules, a multiple tone generator, and a FM tuner module. Three outputs from the auxiliary program input chassis shall be connected to the backplane where their programs may be selected for distribution by the microprocessor-based system.
- G. One DTMF based control console administrative telephone with an LCD display shall be installed in the main office in each SLC and in each Academy. It shall be possible to program and control microprocessor-based equipment with this control console, if this feature is provided by the manufacturer. It shall also be possible to make zone pages and all call pages to assign programs to any or all speakers, to assign individual speakers to time and page zones and to make loud speaking intercom calls.
1. An external 250-watt power amplifier shall be provided for the last switch bank, or of the last 2 switch banks if required.
- H. Telephones: System shall be ADA compliant and utilize DTMF based, 2554 type wall mounted or 2500 type desk phones. Wall phones shall be fully modular. System shall automatically transfer an intercom call made to a loudspeaker to the associated intercom telephone when the phone is taken off hook.
- I. Emergency Calls: System shall possess an emergency call feature, which may be activated by either one of the three following methods: dialing * * and hanging up, by four or more flash-hooks within a two second interval or lift the phone off the hook and wait for a configured length of time (typically 15 or 30 seconds). Emergency calls shall appear at the top of the answer queue and shall ring with a distinctive ring cadence on the designated administrative station or wall display unit.
- J. Wall Display Unit: System shall be furnished with only one wall display unit, which displays the time and call-in information. Emergency calls take priority and flash "HELP", "E" or display station number. Information shall be displayed on LED, VFD, or LCD segments and shall be accompanied by distinct tones for emergency, normal, and call waiting originations. Tone level

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shall be adjustable. The information from telephones installed in the Public Address system shall be displayed on only one wall display installed at the main office. (In some systems the emergency call will not appear until the display phone line is no longer being used).

- K. Privacy Feature: System shall have a privacy feature, which renders impossible unannounced monitoring of intercom conversations from the PA or IC rack, administrative telephones or other intercom station.
- L. Channels: A minimum of eight channels of intercommunication shall be provided together with the Public Address System.
- M. Loop Start Trunk Ports: System shall provide intercom system dial tone for loop start trunk ports from the PABX via Intercom station ports or telephone adapter modules. PABX based DTMF phones shall hear a beep and then receive PA or IC dial tone. It shall be possible to assign various levels of intercom capability to these ports via intercom system programming. These ports shall allow calls from the PABX to individual intercom stations or to access page functions. The Intercom station ports, or telephone adapter modules shall have transformer-based isolation circuits to protect both PA or IC and PABX from harmful transient signals that may be present in the lines. Each Intercom station port or telephone adapter module shall use optical isolators to detect the 90-volt ring signal from PABX station ports. In middle schools and high schools, a minimum of four loop start trunk ports from the PABX via intercom station ports or telephone adapter modules, shall be connected. Two such circuits shall be connected for primary centers and elementary schools.
- N. Interface Modules: System shall be furnished with a telephone interface module to provide up to eight DTMF based telephone ports, which are compatible with 2500 Series, PABX station ports. System shall be provided to allow up to eight simultaneous calls from the intercom system to PABX connected instruments, or to outside lines. These ports shall allow calls from the intercom system to the PABX and shall appear transparent to the PABX. Each port requires one telephone cable pair. Four such circuits shall be connected to the PABX at time of installation. Circular or linear hunt shall not interfere with PABX to PA or IC interface.
- O. Intercoms: System shall provide 2554 or 2500 series telephone in rooms.
 - 1. Provision shall be furnished to connect up to six separate time zone schedule controllers to the microprocessor-controlled system. When a contact closure is provided by a remote time controller, speakers assigned to the time zone will sound a passing tone of standard tone and duration.
 - 2. The Public Address System shall be configured in such a way as to prevent tones initiated automatically or manually from the Public Address console and manually from any telephone when the Fire Alarm Control Panel is in alarm. See standard detail SD 5.14 for Fire Alarm Control Panel to Public Address System physical interface requirements. An additional separate circuit shall also be required to inhibit loudspeaker audio outputs when another separate relay contact closure occurs from the Fire Alarm system. This second closure shall also require activating activation of the muting relay circuits to autonomous PA systems.
 - 3. Central Intercom Switch: Central intercom switch shall fit in standard 19-inch mounting rack. Circuit boards shall be removable from system for inspection and service without disturbing or disconnecting exchange wiring. Units and electronics switches shall be engineered to fit in one 65-inch rack (exchange system and PA system).

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1.06 QUALITY ASSURANCE

- A. Work shall conform to CCR, Title 24 Part 3, Basic Electrical Regulation and National Electrical Code, latest edition.
- B. Only a qualified Contractor holding licenses required by legally constituted authorities having jurisdiction over the work, shall do the work.
- C. Persons skilled in trade represented by work, and in accordance with applicable building codes, shall install system in accordance with best trade practice.
- D. Work shall be performed by a Contractor that has completed at least five school systems of equal scope to system described herein and shall have been engaged in business of supplying and installing specified type of systems for at least five years. Contractor shall maintain a fully equipped service organization capable of furnishing repair service to equipment
- E. Use adequate numbers of skilled workmen who are currently manufacturer certified, thoroughly trained and experienced on the necessary crafts and completely familiar with the specified requirements and methods needed for the proper performance of the work.
- F. Coordinate cable runs, and rack equipment locations with the Owner's Authorized Representative during the initial design of the cable installation. Contractor and OAR must agree as to the final location of devices and the cable plant design.
- G. Provide technicians and tools required to participate in Owners Quality Assurance Testing as detailed in Attachment "A" of this specification.
- H. Items on check list of Attachment "A" will be examined as a minimum at the Public Address Head End, terminal cabinets, ground vaults and classrooms. Should the examination show deficiencies related to items in the checklist, Owners acceptance testing will be discontinued until corrections have been made. When the Contractor has completed the corrections, a subsequent Quality Assurance test shall be initiated. This procedure is in addition to the system functionality testing required in Article 3.03 below.

1.07 WARRANTY

- A. Warranty that work executed and materials furnished shall be free from defects in materials and workmanship for a minimum period of three years from date of installation acceptance, date of Contract Completion, excluding specific items of work that require a warranty of a greater period as set forth in this Specification. In the event a manufacturer's warranty is longer than three years, the manufacturer's warranty shall be the warranty period. Immediately upon receipt of written notice from the Owner, repair or replace at no expense to the Owner, defective material or work that may be discovered before final acceptance of work or within warranty period; any material or work damaged thereby; and adjacent material or work that may be displaced in repair or replacement. Examination of or failure to examine work by the Owner shall not relieve Contractor from these obligations.
- B. Equipment or materials failure rates of ten percent or more during the warranty period:
 1. District shall monitor the performance and reliability of the installed base of Equipment and Materials installed in this Contract. Any deficiencies or malfunctions will be referred to the Contractor for repairs or equipment replacement.
- C. If the District detects a defect within a warranty period as defined here in, it shall notify the Contractor Representative in writing ("Notice of Defect"). Make available and provide the District with the telephone number of a fax machine to receive Notices of Defect. This fax machine shall be available to receive faxes 24 hours per day seven days per week, including weekends and holidays

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- D. Upon receipt of written notice from the District of any failure or defect ("Defect") in any such Equipment or Work, the Contractor shall diligently perform work necessary to determine the cause thereof, and the time necessary to remedy the Defect, and shall propose in writing to the District how and in what manner it will remedy the Defect. If the District determines that the proposal complies with the terms of the Contract, it shall authorize Contractor to proceed to redesign, repair, or replace the defective or failed Equipment or Work within the agreed time period.
- E. In determining the cause of the Defect, perform such investigations and tests as may be required to determine the cause, and to verify that such redesign, repairs, and replacements comply with the requirements of the Contract Document. Cost associated with such investigation, redesign, repair, replacement, and testing, including, but not limited to, the removal, replacement, and reinstallation of equipment and materials necessary to gain access to defective Equipment, shall be borne by the Contractor. Should the Contractor fail to promptly make the necessary investigations, redesign, repair, replacement, and test, the District may perform or cause to be performed the same at the Contractor's expense.
- F. Contractor will warrant the redesigned, repaired, or replaced Equipment against defective design, materials, and workmanship for the remainder of the warranty period or a period of three years from and after the date of acceptance of the redesigned, repaired or replaced Equipment thereof, whichever occurs later.
- G. Contractor shall be liable for the satisfaction and full performance of the warranties as set forth herein.
- H. Warranties are deemed and acknowledged to explicitly extend to the future performance of the Equipment warranted.
- I. The rights and remedies provided for herein are cumulative and shall not be exclusive and are in addition to any other rights and remedies provided by law, whether in contract or tort, or under this Contract.
- J. Contractor is deemed and acknowledged to be a merchant with respect to components and replacement parts furnished pursuant hereto, and the District is acknowledged not to be a merchant with respect thereto.
- K. In the event any Supplier or manufacturer offers any extended warranty not specified herein, state the terms of such warranty or warranties in writing and extend the same to the District without additional cost to the District.
- L. Warranties and guarantees of Suppliers of any tier and Manufacturers, whether expressed or implied, are deemed to be made for the benefit of the District regardless of whether stated as such, and Contractor shall enforce such warranties and guarantees for the benefit of the District.
- M. Include a letter signed by a corporate officer, partner, or owner of the contracting company describing their service organization, its capabilities and commitment to servicing the warranty on work executed and materials furnished.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Public Address Intercommunications system shall be Bogen Multicom 2000/MCP-35A, or equal. In small site projects approved by the PCCD, small paging systems (Bogen PCM2000 or equal) may be integrated with the site PBX.
- B. Analog Clock

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1. Analog Clock shall be Bogen BCAL (wireless analog).
2. A Public Address and Intercommunication system shall not be expanded past the stations or ports capacity stated in the manufacturer's product specifications.
3. The Bogen Quantum Multicom 2000/MCP-35A is permitted for sites with any number of stations. Interconnecting two card cages, each with a Quantum processor card by use of an Ethernet cable is permissible. Use of SIP1 classroom phones are not permitted.
4. Voice over IP systems or Voice over IP integrated design systems shall not be accepted except in projects approved by PCCD.

2.02 SYSTEM EQUIPMENT

- A. System Equipment Rack: The following specifications apply to equipment furnished with the Public Address or Intercommunications System.
- B. The equipment rack shall provide a minimum of 77 inches of vertical panel space to accommodate 19-inch panels having 1 ¼-inch by ½ inch mounting spacing. The rack shall be 22 3/8-inch wide by 18 ½-inch deep by 81 3/8-inch high, with louvers and knockout openings on the sides and rear. There shall be a rear door having slip-joint hinges for easy removal without the use of tools. The rack shall be constructed of 16-gage steel. The rack shall be finished in black enamel. Cabinet shall be constructed with mounting rails tapped for No. 10-32 screws on EIA spacing front and rear. Cabinet shall be tested and certified to the seismic specifications set forth by NEBS Telcordia Technologies GR-63-CORE. Calculations for seismic bracing shall be based on the maximum load rating of the cabinet by the manufacturer in a CBC regulated environment, not the weight at time of occupancy. Rack shall be UL listed.
- C. Central Card Cage or Shelf Assembly:
 1. Central Processor Card
 - a. Contains the system software that controls system features, functions, connections, audio, data and configuration for the DTMF controlled part of the Public Address and Intercommunication System.
 2. Intercom Telephone Cards or Speaker Cards:
 - a. An intercom telephone card or speaker card shall be provided for PA or IC ports for which intercom telephones are provided or for which intercom access is required.
 3. Interface PA or IC to PBX
 - a. System shall be equipped to provide eight simultaneous calls from the intercom system to a PBX., Direct connection to outside lines in the absence of a PBX, if software restricted to 911 only, may be permitted on a case by case basis with permission from the Telecommunication department.
 4. Interface PBX to PA or IC
 - a. Provide Intercom station ports or telephone adapter modules to allow four loop start trunks from PBX to obtain access to intercom system dialing capabilities.
- D. Administrative Display Telephone:
 1. Telephones shall be designed to work with intercom system, shall utilize DTMF dialing and shall be furnished with the following features:
 - a. Function keys and display: Telephone shall be furnished with a standard 12-button keypad and LCD display for full alphanumeric menu-driven operation.

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- b. Telephone shall display station numbers with priority levels for incoming calls. Unique ring tones and flashing message or station number on display shall distinguish emergency calls from other calls.
- c. Telephone shall provide two-way, hands-free speaker operation and private handset operation. Handset shall be fully modular with a dynamic receiver and transmitter compatible with adjustable volume handset for the hearing impaired.

E. Intercom Instruments:

- 1. Wall-mounted: Intercom instrument shall be fully modular Series 2554 telephone instrument with industry standard DTMF keypad and 90-volt, 20 Hz compatible bell ringer. Unit color shall be cocoa brown. Unit shall be mounted with screws through the base; connections shall be provided directly to the network card. The handset cord shall be fully modular.
- 2. Desk-mounted: Intercom instrument shall be fully modular Series 2500 telephone instrument with industry standard DTMF keypad and 90-volt, 20 Hz bell ringer. Unit color shall be cocoa brown.
- 3. The bell ringer loudness control for both classroom wall-mounted and classroom desk-mounted sets shall be fixed to the loud position permanently. The loudness control for the ringer shall not be adjustable.

F. Ring Adapter Cards:

- 1. A ring adapter card shall be provided at PA or IC ports for which intercom telephones are required. This card shall provide standard 90 volt, 20Hz cycle to the telephone instruments to allow industry standard 2500 Series desk and 2554 Series wall telephones to be furnished.

G. Wall Display Unit:

- 1. One wall display unit shall be provided and shall display time of day, station number and call priority. Unit shall provide unique ring tones to distinguish emergency calls from non-emergency calls. Emergency calls shall move immediately to the top of the queue and shall be accompanied by flashing "HELP", "E" message or the classroom extension number. Alternative characteristics are permissible if they follow the manufacturer's published description.

H. Intercom or Program Distribution Control Panel:

- I. The analog PA system shall be modified versions of the Bogen Model MCP-35A, Rauland MCZ-300 or Dukane 3200 without switchbanks. The intercom function shall be disabled due the absence of switch banks. Remove or cover intercom operational labeling that has been deactivated.
- J. The control panel shall be solid-state and designated for continuous duty service on line voltages of 120 volts, 60 Hz AC.
- K. It shall be furnished with two separate amplifiers. The program amplifiers shall provide a minimum of 35 watts RMS at less than one percent distortion at rated power and bandwidth. The frequency response shall be within + one, -3dB from 80 Hz to 15 KHz. The intercom amplifier shall be furnished with an output rating of 15 watts RMS; frequency response shall be shaped for maximum intelligibility. Both amplifiers shall provide balanced 25-volt line output.
- L. It shall be furnished with inputs for two Lo-Z balanced microphones, one Hi-Z unbalanced auxiliary input, telephone paging accessories and booster amplifier. Terminals shall be provided to activate the time signal feature and Telco page feature.

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- M. It shall provide controls necessary for two-way intercom communication with any classrooms, communication with any classroom, distribution of general announcements or program material to classrooms, and transmission of emergency announcement to classrooms. Provisions shall be included to permit emergency paging from a remote telephone, or microphone, which shall capture system priority and override all functions except for the emergency page feature.
- N. AM-FM Tuner and
- O. CD Player/Changer
- P. Power Amplifier
- Q. The Power amplifier shall be a solid-state amplifier with transformer isolated output for 25V systems. Direct coupled amplifiers shall not be accepted.
- R. The amplifier shall provide an audio output of 250 watts rms continuous or value as determined by design calculation. The rated output shall be obtained with and input that is not greater than 500m V(rms).
- S. The amplifier shall provide either balanced or unbalanced constant-voltage outputs of 25 volts and 70 volts, plus four and eight ohm balanced or unbalanced outputs. Output regulation shall be within 2dB from no load to full load.
- T. The amplifier shall incorporate electronic shutdown circuitry, which shall activate whenever and overload or short occurs on the output of the amplifier. A front panel overload shutdown LED shall illuminate to indicate the discontinuance of power output once the cause of the shutdown condition had been removed.
- U. The amplifier shall be furnished with thermostatic control to prevent operation at excessive ambient temperatures. The amplifier also shall include electronic overload limiting and short-circuit protection and shall be properly fused and rated for continuous operation.
 - 1. The standard amplifier shall be furnished with an EIA 19-inch front panel suitable for rack mounting.

2.03 ANTENNA AND GROUNDING

- A. Antenna and Accessories:
- B. FM Antenna: Furnish and install a Blonder Tongue BTY-2-FM, or equal, all-direction FM dipole antenna on roof at indicated location. Lead-in cable shall be 75-ohm weatherproof coaxial type, equipped with necessary weatherproof matching transformer at each end. Cable shall be Belden 8241, or equal. Provide a weatherproof surge protector, with # 6 AWG grounding conductor to a grounding electrode. The grounding conductor shall be bonded to the mast and surge protector
- C. AM Antenna: Furnish and install a whip type AM antenna. Antenna shall be insulated from ground. Guy AM antenna whip from mast with an insulated standoff. If signal strength is not adequate from such an antenna, provide and install a 30-foot length of hard drawn #12 copper wire between new roof antenna masts. Lead-in wire shall be 75-ohm coaxial cable, Belden 8241, or equal, furnished with necessary matching transformers at each end. Provide a weatherproof surge protector, or equal with # 6 AWG grounding conductor to a grounding electrode. The grounding conductor shall be bonded to the mast and surge protector.
- D. Provide and install an AM/FM antenna coupler in outdoor housing mounted on antenna mast.
- E. Provide and install an antenna mast on roof of closest building to the PA rack or as indicated on Drawings. Mast shall be 1-1/4 inch galvanized steel and shall be secured to roof joists with steel straps specifically manufactured for installation.

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- F. Provide and install ¾ inch antenna conduit from PA console to antenna. Provide and install a weather head, roof flashing.
- G. Grounding:
 - 1. Wiring enclosures, terminal cabinets, outlets, frames of cabinet racks and other enclosures shall be grounded in accordance with requirements of California Electrical Code and as specified.
- H. Chassis of amplifiers, power supplies, and other electronic power equipment shall be grounded by bonding to control cabinet.
- I. Housing and grips of microphone and conductive housings and other equipment shall be grounded by means of grounding wire or shield in cord or cable furnished for equipment connections.
 - 1. Circuits shall be grounded as recommended by manufacturer of equipment to which they are connected unless otherwise specified.
 - 2. Furnish, install and bond a #6 AWG, green grounding wire from the main public address terminal cabinet to console equipment rack main terminal. Frame of console and circuit wiring requiring grounding shall be grounded to ground system at equipment rack main terminal. Loudspeaker circuits and communication circuits shall operate balanced to ground.

2.04 SPEAKERS AND ACCESSORIES

- A. Loudspeakers:
 - 1. Each loudspeaker mechanism shall be mounted in flush back-box or surface baffle as indicated on Drawings and as specified.
 - 2. Frequency response of loudspeakers shall be considered to be frequency response of speaker together with its associated line transformer. Power rating of each speaker shall be its capacity to reproduce, with satisfactory frequency response and performance, at rating level specified. Adjust power delivered to each speaker, as necessary, to ensure a satisfactory sound level, with reproduction of good quality, in each of locations where speakers are installed.
 - 3. Speaker mechanism shall be eight-inch diameter, cone type radiating element, 9,500 gauss per square inch Alnico 5 magnet, and moving coil type. Cone shall be seamless. Sensitivity shall be a minimum of 94 dB SPL per meter at one watt. Power handling capacity shall be a minimum of 15 watts RMS. Magnet shall have a minimum weight of ten ounces. Nominal frequency response shall be 80 to 8,000 Hz. Speakers shall be Quam 8C5PAX, or equal, unless otherwise specified.
 - 4. Loudspeaker Volume Controls: Loudspeaker volume controls shall be "L-Pad" attenuators of suitable impedance or autotransformer attenuators with 10 steps (and off). "T-Pad" or potentiometer shall not be accepted as a loudspeaker volume control. Furnish, install and connect volume controls on loudspeakers located in areas other than classrooms. For wall-mounted baffles, install control within baffle with shaft extending through bottom. For ceiling-mounted speakers, install volume control on wall in a convenient location. Provide shaft with round knob and dial-plate to indicate position of setting. Loudspeaker volume controls shall be installed only where indicated on Drawings.
- B. Impedance Matching:
 - 1. Speakers: Each loudspeaker shall be provided with a line transformer having taps as necessary for proper matching and proportioning power to speaker. Frequency response

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of each transformer shall be within 3dB from 70 to 10,000 Hz. Minimum power handling capacity of each transformer shall be a minimum of 2.5 watts. Transformers shall be Triad S-79Z, or equal.

2. Line:

- a. Each line-matching transformer shall be furnished with similar frequency response as speaker transformer and be shielded and equal to TC-LS-34.
 - 1) Speaker line impedances shall be selected as necessary to limit distortion to a minimum. Line loss to any speaker operating at normal input shall not exceed 1 dB. Speaker matching transformer shall be connected to provide a satisfactory division of power among speakers. Sum of power distributed to speakers connected to any one-power amplifier shall not exceed 66 percent of amplifier power output rating specified herein.
 - 2) Impedance and signal level matching is required.

C. Types of Speakers:

1. Type "A" Flush Mounted Speakers:

- a. Speaker baffle shall be a vandal-proof, round, flush-mount Quam model ES8-CK, or equal. It shall be constructed of #14 gage carbon steel with a tensile strength of at least 55,000 psi. Finish shall be white baked powdered epoxy, virtually scratch and mar resistant. Baffle shall incorporate a sub-plate fabricated from heavy-gage steel that shall provide an interlocking lattice grid pattern to protect speaker from tampering and vandalism. Protective sub-plate shall be acoustically transparent. Sub-plate and speaker shall be secured by means of casehardened square-shanked carriage bolts. Baffle shall mount in a Quam ERD-8NS backbox by means of tamper-proof hardware provided.
- b. Backbox shall be a Quam ERD-8NS, or equal, recessed round enclosure designed to accommodate 8-inch speaker or baffle assemblies. It shall be made of one-piece #22 gage drawn steel with a rust-inhibiting coating, and an interior treated with a fire-retardant resonance damping material. Bottom inside of backbox shall have affixed a 9-inch pad of 3/8 inch thick acoustic foam to provide additional resonance and vibration control. Four combination conduit knockouts 1/2 inch and 3/4 inch shall be deeply scored, but not through, to preserve leak-free integrity of enclosure in air plenum installation. These combination knockouts shall be spaced 90 degrees apart.
- c. Provide spanner type tamperproof screws to secure grille to backbox.

2. Type "B" Surface-Mounted Speakers:

- a. Type "B" surface-mounted speakers shall be a Quam VP2, or equal. Speaker shall be quality 8-inch type, complete with a 25V/70V line matching transformer tapped at 1/2, 1, and 2 watts. Speaker frequency response shall be 50 to 15,000 Hz, with an axial sensitivity of 96dB per meter with one-watt input. Power rating shall be 15 watts. The speaker shall incorporate a 10-ounce ceramic magnet; the voice coil shall be 3/4 inch in diameter and shall have an impedance of 8 ohms.
- b. Speaker or transformer assembly shall be mounted in a wall-mount, sloped baffle constructed of special heavy-gage cold-rolled steel which shall be virtually impervious to direct blows: steel back mounting plate shall be pre-punched to fit any standard outlet box and shall be so designed as to make it practically impossible to gain access to speaker. Type 6-32 tamperproof machine screws shall be used to attach baffle to steel mounting plate. Mounting plate shall be installed so that baffle is perfectly level.

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- c. Entire assembly shall measure 13 ¾-inch high, 10 7/16-inch wide, 5 ¾-inch maximum depth, and 4 3/8-inch minimum depth. Baffle shall be finished in semi-gloss white epoxy. Complete hardware shall be provided with speaker assembly.
- 3. Horn Loudspeakers:
 - a. Type "C" Horn Loudspeakers: Horn loudspeakers shall be weatherproof vandal-proof type. Speakers shall be Atlas model APF15T with Soundolier VP410S baffle and VPA-APF adaptor, or equal. Furnish and install weatherproof cover plates with plastic bushed holes in plates to admit waterproof cable to speaker in drip loops. Each horn speaker assembly shall be mounted in a vandal-proof steel enclosure. Submit a drawing of assembly to the Architect for review. Type "C" horn loudspeakers shall be furnished for outdoor areas such as lunch shelters, arcades, walkways, etcetera. Note that sound travel distance for this horn is less than the C1 horn due to its higher low frequency cutoff point.
 - b. Type "C1" Horn Loudspeakers: Horn Loudspeakers shall be weatherproof and vandal-proof types. Speakers shall be Atlas Model APC-30, or equal. Furnish and install weatherproof cover plates with plastic bushed holes in plates to admit weatherproof cable to speaker in drip loops. Each speaker assembly shall be mounted in a vandal-proof steel enclosure. An optional access door may be provided if secured with fasteners that require a tool to remove or secured with a Cat-60 padlock. The access door, if provided, shall be large enough to remove the horn driver, change taps, adjust the tilt of the horn, or remove and test the cabling. Submit a drawing of assembly to the Architect for review. Type "C1" horn loudspeakers shall be furnished for large outdoor areas such as playgrounds, physical education fields, athletic fields, etcetera.

2.05 ELECTRONIC RECEPTACLES

- A. Microphone receptacles shall be Cannon XLR or SLR Series, or equal. Receptacles shall be furnished with mounting brackets for floor boxes, Sierra, or equal, .040-inch stainless steel plates, unless noted otherwise on Drawings. Each plate shall be engraved with its receptacle function in 3/16-inch high letters filled with black paint. Receptacles shall conform to following:

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<u>Type</u>	<u>Description</u>	<u>Model</u>
"A"	Single Microphone male	LR-3-14, on a one-gang plate receptacle wall mounting
"B"	Single microphone male	LR-3-14N, with a CA015-0094-000, receptacle floor mounting yoke.

2.06 CONDUCTOR OR CABLES

- A. Cable for overriding Autonomous PA system shall be one twisted pair, #18 conductor: West Penn #CL2 293, or equal. For outdoor and underground applications, West Penn Wire Corp. # AQ 293 shall be furnished. This stranded wire shall not terminate on 66 or 110 blocks. Install and use screw terminal strips adjacent to the punch blocks.
- B. Cables for microphone and other input sources and speakers shall comprise one twisted pair of #22 gage solid copper conductors; polyethylene shielded with an aluminum foil-mylar shield, a #22 gage stranded tinned copper drain wire and polyvinyl jacket. Cable shall be West Penn Wire Corp. CL2 290, or equal. For outdoor and underground applications, West Penn Wire Corp. # AQC 291 shall be furnished.
- C. Two-pair #22 gage, fully annealed copper wire. One twisted pair (black and red) conductors shall be shielded and the other twisted pair (green and white) shall be unshielded. Both pairs shall be under one jacket. This cable is to be provided for combination telephone and public address Work. Furnish shielded pair for speaker lines. Mohawk #1772, West Penn CL2 #355, or equal. For outdoor and underground applications, West Penn Wire Corp. # AQC 355 shall be furnished.
- D. Jumper wire or cross connect wire shall consist of solid copper conductors, insulated with polyvinyl chloride and color coded, #22 gage, Brand-Rex, or equal.
- E. Cable for types C and C-1 speakers shall be West Penn CL2, AQ or AQC, as required, 289, 290, 291, 292, 293, 294, 295 or 296. Cable provided shall be selected based on calculation of the cable gage required to produce no more than a 1 dB drop in voltage at the load, given the load at which the speaker is tapped and the distance the cable is run. At the main PA termination field or at any other termination field, do not use the 66 punch blocks for any stranded wire. Install and use screw terminal blocks adjacent to the 66 blocks or remove one of the 66 blocks if adequate room is not otherwise available for these screw terminal blocks.
- F. Interface cable from clock controller to the Public Address rack shall provide a minimum of twelve AWG 20 insulated conductors. Cable shall be West Penn 265, West Penn 283, or equal. For exterior or underground applications, provide West Penn AQ224 two conductor AWG 18 cables, or equal. Termination shall be inside the master clock and inside the PA rack only for a continuous cabling run. Label clock connections where cable terminates inside of rack.
- G. Cables between the P.A. rack and P.A. terminal cabinet for connection of switch bank positions to field circuit shall be Two-pair #22 gage, fully annealed copper wire. One twisted pair (black and red) conductors shall be shielded and the other twisted pair (green and white) shall be unshielded. Both pairs shall be under one jacket. Mohawk #1772 or West Penn CL2 #355.

2.07 TERMINAL BLOCKS AND CABINETS

- A. Terminal blocks shall be solderless push-on (#20 to 22 gage solid) with integral fanning strip. Solderless push-on type blocks shall be Siemon Company 66-Series. Terminals for connections to external circuits shall be properly labeled. 66B blocks shall be mounted directly to terminal

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location without use of mounting legs. 66M blocks shall be mounted on 89B mounting spacers. Install the required terminal blocks as necessary within each cabinet.

- B. Terminal blocks shall be installed on back of cabinets only, not on sides. Incoming cables shall be terminated on outside pins of terminal blocks and outgoing cables shall be terminated on second pin from buttside edge. This method shall be provided at satellite terminal locations. At main or cross-connect terminal locations incoming or outgoing cables shall be terminated on outside pins, but with jumper wires terminated on other points. Do not install grouped station cables other than 25, 50, 75 and 100 pairs of telephone cables under terminal blocks.
- C. Auxiliary cabinets shall be securely floor or wall-mounted, in a position that will not block removable panel or swing open doors needed for normal system expansion or service. Doors shall be lockable with a door-mounted lock.

2.08 KEYS AND LOCKS

- A. Provide keys and locks for cabinets and equipment; locks shall be keyed to a Corbin #60 key, for access to operate equipment and Corbin #70 key, for access to service equipment.

2.09 PORTABLE EQUIPMENT

- A. Furnish and deliver to the OAR, one auxiliary console microphone with coiled cord and press-to-talk switch.
- B. Portable equipment shall remain in individual boxes and be delivered to the OAR.

2.10 LOADS ON EQUIPMENT AND COMPONENTES

- A. Equipment and component parts shall carry continuously, without undue heating or change in rated value, loads connected thereto and rated output loads where such are specified. Equipment shall be properly fused. Components and parts shall be designed for continuous operation.
- B. Operating voltages on capacitors shall not exceed 60 percent of their rated working voltages.
- C. Operating wattages to be dissipated by resistors shall not exceed 25 percent of their ratings.

PART 3 EXECUTION AND INSTALLATION

3.01 INSTALLATION

- A. Install equipment as specified, as indicated on Shop Drawings, and as required. Installation shall be in accordance with manufacturers' instructions and applicable codes. Installation shall be in accordance with manufacturers' instructions and applicable codes.
- B. Systems that are re-designed with the intention to increase station or port capacity of systems shall not be accepted.
- C. Systems not installed as manufacturer instructions shall not be accepted.

3.02 RELATED SYSTEM OR SUB-COMPONENT INSTALLATION

- A. Public Address system installation
 - 1. Rack Equipment Installation: Equipment within each rack shall be logically arranged for accessibility of convenient maintenance. Equipment shall be mounted on shelves or panels and shall be securely attached. Allow 20 percent expansion in the form of empty rack units

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at time of occupancy. Empty rack unit spaces shall be covered with factory made plates of the same manufacture as the cabinet.

2. Amplifiers, power supplies and other heavy devices shall be mounted on steel shelves made by manufacturer of console and cabinet racks and shall be attached to cabinet by means of rack mount brackets. Heavy devices shall be mounted in the lowest practical space in the rack. Cabinet, console, and panel faces, including drawers shall be the same color. Punch blocks, screw terminals and ancillary equipment shall be installed on metal rack panels mounted on rear rails. Cables to such panels shall be dressed only from the right side of the rack, as viewed from the rear. The cable bundle must be dressed so as to allow the panel to be swung out for service.
3. Wiring within console and cabinets shall be installed to conform to standard engineering practice and shall be terminated on terminal strips having a terminal for each required external connection. Wiring shall be cabled, laced and securely fastened in place so that no weight is imposed on any equipment, control switches, or terminals. Wires shall be contiguous between console and cabinets. Splices are permitted only at cross connect points where terminated on punch blocks.
4. Wires carrying audio power shall be shielded. Input and output circuits and terminal strips shall be installed to provide separation necessary for proper operation. Wires shall be identified by number and chart.
5. Cable charts shall be bound to rear cabinet door of PA or IC cabinet, MPATC or backboard, terminal cabinets and service manuals inside transparent plastic envelopes. The information in these charts shall include cable's switch selector position number, designated switch bank, EZ label number from switch bank to main cross connection, EZ label number from main cross connection to end device, speaker wattage, telephone extension number, punch block locations and end device location (classroom number, office, hallway, exterior wall etc).
6. PA or IC cable terminations and connections on 66 Series blocks at terminal cabinets, backboards and MPATC shall be installed from top to bottom in office and classroom logical numerical order and shall maintain the same numbering system throughout the site. It shall follow the orderly sequence used for switchbanks room selector switches.
7. Conductor shields for each system shall be grounded at one location only. Grounding shall be provided within console and cabinet racks. There shall be no metallic connection between systems. Conduits for system and 120-volt AC system shall be bonded together at console and cabinet racks.
8. 120-volt AC supply conductors shall be terminated directly on disconnect switches specified and in a recognized raceway.
9. A minimum of 24 spare stations or ports shall be provided for system expansion capacity, even if this requires installation of a second card cage and ancillary equipment. The required equipment and connectivity shall be provided to allow for this 24 station spare capacity regardless of the stations provided at the time of occupancy. The 24 spare stations shall be readily available for connectivity to classrooms, offices or specified location. The 24 station shall be clearly labeled and terminated on a punch block in the main public address terminal cabinet
10. A minimum of 25 spare communication cables shall be provided between the P.A. rack and the main PA terminal cabinet. 25 communications cables shall be connected to the respective telephone card, speaker card, relay module, ring module and switch bank. The 25 spare ports shall be active and ready for connectivity now or for future expansion. These

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25 spare communication cables are for connection of switch bank positions to field circuits and are in addition to override, remote input, and other miscellaneous cables required for the P. A. rack.

11. At the main PA cabinet these cables, along with the other miscellaneous cables shall be neatly dressed and secured to the backboard. At the backboard they shall be routed around the exterior of the backboard so as to assure the availability of at least six feet of spare cable, terminated, bundled, secured and routed by the most direct path.
12. At the PA rack the cable bundle shall be neatly dressed and secured to the back-mounting rails of the PA rack. If the conduits enter from the top of the rack, route the bundle down the left side of the rack as viewed from the rear, across the bottom of the rack and up the right side. Cables shall be broken out from the right-hand side, dressed, secured, and routed to their termination point. If cables enter from the bottom, route them up the left side, over at the top and down the right side for breakout, dress and termination.

B. Telephone interface system installation

1. Install, program and connect 4 circuits to the PABX system. Upon notification from the Contractor, the OAR shall contact the Telecommunications Branch to arrange for ordering of necessary additions to the voice system to coincide with the completion of the installation of the PA or Intercom system. Label circuits with tag at the punch block, and inside the PA rack.
2. The work provided by the Owner will encompass both hardware or software additions and any necessary programming.
3. The Telecommunications Branch will manage connections to the PBX voice system from the 66-block located under the PBX to the 110 block also located under the PBX. The contractor is responsible for the cabling, conduit, and connections from this 66 block (ports on block typically labeled by the Telecom Branch) to the main PA termination field 66 blocks.
4. Contractors working on the telecommunications system must be pre-approved by the Telecommunications Branch prior to start of construction.

C. Telephone access installation for incoming call:

1. Provide, install and connect 4 ports for High and Middle schools and 2 access ports for Elementary schools and primary Centers to allow loop start trunks from the PABX to obtain access to intercom system dialing and function capabilities. These circuits shall be used only to interface PABX to PA or IC.
2. Clearly label cabling for PBX connected telephone ports with a tag inside rack and on the punch blocks.

D. Administrative display telephones

1. Provide, program, install and connect a minimum of one administrative telephone in the Main Office, in each SLC and in each Academy.
2. Connect the administrative telephones in sequential order starting on the first circuit of the first switch bank relay card.
3. Wall Display Unit: Install unit in the main office unless indicated otherwise on Contract Drawings, in accordance with manufacturer's instructions. For Bogen PA systems, verify and change if necessary, the ring voltage for the display tip and ring pair by moving the voltage selection shorting plug to 12v on the ringer card inside the PA rack. This associated ringer card station port is typically port number one and shared with the main display phone (they ring together, both were designed to operate off of a 12v ring signal and act erratic if

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provided a 90v ring signal. (To be precise, the Bogen Multicom 2000 delivers a 60v ring signal from the ringer card, or a 12v square wave ring if the card is bypassed).

E. Intercom instruments

1. Wall-mounted: Install where indicated modular wall plate.
2. Desk mounted: Install and connect where indicated and specified.

F. Special programming requirement

1. Privacy
 - a. The system shall be configured to prohibit the initiation of a two-way conversation from any telephone or speaker to any speaker connected to the system without the presence of a supervisory, or privacy tone. This requirement extends to calls from the office to any classroom, from a classroom to any other classroom and from any classroom to any office. The tone shall annunciate at the initiation of the call and a minimum of every 15 seconds thereafter. The tone shall have sufficient volume to alert the occupant of a classroom with typical ambient sound that a two-way communications path has been initiated.

G. Terminal cabinet installation

1. Lines and cables within cabinets and on main terminal backboards shall be carefully dressed with cable ties. Cables shall be formed into bundles from their emergence from conduits and shall make a 360-degree wrap around the inside of the cabinet or the exterior edge of the backboard. Cables shall be formed into a rectangular configuration and secured to the backboard. Each cable shall be properly enumerated in numerical order with commercial wire markers and shall maintain the same number throughout the site. Wire markers shall be uniformly located within one inch of the end of the cable jacket and the numbers shall be immediately visible.
2. Conductors shall be color-coded, and individual cables shall be rung out, and tagged with code markers such as W.H. Brady Co. or E-Z Code wire markers. Each cable index strip shall be typed and installed on terminal cabinet door. Each index strip shall be covered with Zellerbach # R125, or equal, typed on "as-built" drawings.
3. Terminations and connections throughout system shall be on Siemon # 66 series blocks, except at equipment that requires removal for servicing and for terminating stranded type cable. Connections to such equipment and cables shall be screw-terminal type or plug-in type. Wires connected to screw-terminal blocks shall use spade lug type terminal connectors for attachment. 110 terminating blocks shall not be accepted as a replacement for 66 series terminating blocks. Cables shall be identified as to buildings and rooms served and terminated in terminal cabinets and backboards.
4. Cables from Telco interface blocks shall terminate on left side of 66 M1-50 blocks, with jumpers leaving from right side-bridge with Siemon Co. sneak current protector units.
5. Cables to public address system console or amplifier inputs shall terminate on 66 M1-50 blocks.
6. Cables from public address console or amplifier outputs shall terminate on 66M1-50 blocks; provide blocks for required number of switches.
7. Cables to PABX switch (trunk inputs) shall terminate on 66 M1-50 blocks, if only PABX system is included in this Contract.

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8. Cables to PABX switch (extension, console, night bells, etc.) shall be terminated on 66 M1-50 blocks. Provide blocks and cables for maximum possible system configuration, if only PABX system is included in this Contract.
9. Cables to satellite terminal locations and or classrooms shall be terminated on 66 M1-50 blocks. Provide blocks as required, plus 2 vertical rows of 89B spacers for future expansion, at main cross-connect locations only.
10. Cables from auxiliary equipment shall be terminated on 66 M1-50 blocks. Provide blocks as required, plus space for a future block.
11. Feeding cables at remote cross-connect locations shall be terminated on 66 M1-50 blocks for jumpering.
12. Blocks shall be mounted in vertical rows only. Cable with lowest number shall be terminated on upper left side, with next cable in numerical order just below first cable and so on. When left side of first row of blocks is full, next cable in numerical order shall be terminated on the upper right side of first row of blocks, and so on.
13. Do not pass grouped cables in area that is to be used for jumpering. Cables shall enter blocks from top or bottom only and shall not be in same area as jumper wires.
14. Cable distribution rings for jumper wires shall be Dracon Industries #10910-00, or equal.
15. Cable distribution rings for inside wiring cable and distribution cable shall be Dracon Industries #10941-000, 10942-000 or 1094-000, size as required.

H. Conduit

1. No more than 6 feet of flexible conduit shall be used in any conduit run.
 - a. Flexible conduit shall not be used in concealed or inaccessible areas such as interstitial wall spaces or hard lid ceilings.
 - b. Where flexible conduit is used, the conduit fill shall be de-rated by one trade size.
 - c. Flex shall not be used from MPATC or backboard to the PA or IC rack.
2. Pull boxes shall not be used in place of conduit bends unless site conditions do not allow the use of conduits with data sweeps. If pull boxes are proposed, it must be approved by the Owner.
3. Where not required elsewhere in District Specification or Code, pull boxes shall be sized per the BICSI TDMM current Edition, Chapter 5, Table 5.13.

3.03 OWNERS QUALITY ASSURANCE CERTIFICATIONS AND TESTING

- A. Provide instruments for testing and demonstrate, in presence of the Owner, that circuits and wiring test free of shorts and grounds.
- B. Provide test and reception gear to test for specified performance of active equipment.
- C. Furnish labor, instruments, appliances, equipment, and materials necessary to demonstrate to the Owner the installation performs as required and specified.
- D. Before Substantial Completion, submit test results and related documents to the Project Inspector.
- E. The Owner reserves the right to perform independent tests of equipment furnished, to determine whether or not equipment complies with requirements specified, and to proceed in accordance with the Contract Documents.

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3.04 PROJECT RECORD DOCUMENTS

A. As-Built Documentation

1. Provide three copies size E (30 by 42-inch) of Project site and building plans, indicating location of equipment, conduit, cable routing, ground vaults terminal cabinets, pull boxes and other installation information.
2. Provide three CDs of the system CPU programming and configuration.
3. Provide two copies of the record Drawings in DWG format prepared using the most recent version of AutoCAD on a labeled CD-ROM for use on a Windows platform.
 - a. Public Address wiring shall be shown on a separate layer, labeled as "Public Address" that uses both building floor plans and conduit supporting structure layers below. The use of any version control blocks or company logos shall be on a layer separate from the premise wiring as-built drawings.
 - b. AutoCAD files (software copies) supplied shall be multi-layer drawings with the following layers as a minimum:
 - 1) Layer one shall contain title blocks only.
 - 2) Layer two shall contain building or site plan backgrounds only.
 - 3) Layer three shall contain devices, cabling and other system components.
4. Floor plans indicating devices, terminal cabinets and cross connect locations, conduit runs, ground vaults, wire types, cable routing of cables, both underground and in each building with conduit fill and count, and as-built coding used on each cable.
 - a. Drawings shall include block diagrams indicating items and their point-to-point connections in a manner following floor and site plan layout. Drawings shall also include as-built single line diagram, cable site plot plan and floor plans indicating cables, both underground and in each building with conduit, and as-built coding used on each cable.
 - b. Floor plans shall indicate devices, terminal cabinets and cross connect locations, conduit runs, ground vaults, wire types, cable routing of cables, both underground and in each building with conduit fill and count, and as-built coding used on each cable

B. Operating and Servicing Manuals, Record Drawings:

1. Deliver three copies of operating and servicing manual. Each complete manual shall be bound in three ring binders and data shall be typewritten or drafted.
 - a. Each manual shall include a page with Project site and Project name, date of Substantial Completion, Contractor name, address, telephone, and fax numbers.
 - b. Each manual shall contain a letter, signed by an officer of the company indicating the beginning and ending date of any warranties described in Article 1.07 of this section and shall describe the companies' commitment to service the warranty during the terms specified.
 - c. Each manual shall include instructions necessary for proper operation and servicing of system and shall include:
 - 1) A single line diagram of the system indicating items and their point-to-point connections in a manner following floor and site plan layout.
 - 2) A complete two wire diagram of connections made between components inside the system console.
 - 3) A wiring destination schedule for each circuit leaving console and each rack.
 - 4) Custom fabricated circuits, components and connections not detailed in the manufacturer's manuals shall have wiring diagrams detailing to component level,

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the manner in which the circuits are connected. Provide details of input or output voltages and input or output signal levels.

- 5) A schematic diagram of each amplifier and other components, transistor complements and replacement part numbers.
- d. Each manual shall also include as-built single line diagram, cable site plot plan and floor plan indicating cables, both underground and in each building with conduit, and as-built coding used on each cable. Drawings Size A (8 ½ by 11) and size B (11 by 17) shall be bound into the manual. Larger drawings shall be folded and inserted into transparent envelopes bound into the manual. Programming forms of each system shall be submitted with complete information.

3.05 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.07 OWNER ORIENTATION

- A. Before Substantial Completion, provide an eight hour Owner instruction period to designated Owner personnel. Contact OAR first, if assistance is needed in scheduling an appropriate time, location, or list of attendees for this training.
- B. Instruction shall be based on manufacturers written operating instructions covering those features of interest to the Owner and applicable to the Work. Instruction shall include the following:
 1. Making normal calls from intercom telephone to other intercom telephones or to the intercom administrative station. Revisit office staff preferred method for clarity and understanding of function and methodology.
 2. Answering normal calls from intercom telephones.
 3. Transferring loudspeaker intercom calls from the speaker to the intercom phone.
 4. Answering normal or emergency calls from the intercom administrative station.
 5. Returning calls shown in the administrative station display queue.
 6. Answering calls shown on the wall display from PABX phones (remote answer feature).
 7. Answering calls ringing at a secondary station from admin phone or assigned intercom phone.
 8. Placing calls from PABX phones to intercom station.
 9. Placing calls from intercom stations to PABX phones.
 10. Placing calls from intercom telephone to the public switched telephone network (PSTN).
 11. Making intercom calls from PA or IC rack to classrooms.
 12. Show how to set the passing bell schedules if selector switch is located on PA rack but might have been replaced by a remote selector in the main office.
 13. Making an emergency all call from the rack, program all call, zone all call and individual announcement from the admin telephone and PABX telephone, and all-call from the hand held microphone located in the main office. Explain that emergency all-call from rack activates the hearing assistance system. Also explain where these hear assistance systems and the autonomous systems are located.

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14. Show distribution of radio or cassette player and CD player programs. and from which web sites the instructions can be downloaded.
 15. Provide copies of manufacturer user's manual to training staff and explain users' manual functions described. Provide 3 quick user's functions reference guides in a plastic laminated form. The training shall include hands on equipment.
- C. After Substantial Completion, and before contract completion, provide two additional one hour "refresher" instruction sessions at times agreed upon by the Owner.

END OF SECTION

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SECTION 27 51 26 - ASSISTIVE LISTENING SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Complete and working assistive listening systems are required in all areas of assembly.

1.02 SUBMITTALS

- A. The Builder shall be required to submit descriptive data sheets for each type of product proposed, providing sufficient data to verify compliance with the specifications provided.

1.03 SYSTEM DESCRIPTION

- A. Each system shall include an FM transmitter with antenna(s) and two or more FM receivers, all operating in the 72 - 76 MHZ band. Both transmitters and receivers shall operate properly with FM receivers and transmitters, respectively, of other manufacturers listed below using the same frequency. These Standards require the provision of interoperable, industry standard type systems; proprietary systems are specifically not acceptable. Builder required submittals shall include a complete description of all incompatibilities.
- B. In areas with a sound reinforcement system, the assistive listening system shall retransmit the sound reinforcement system electrical output. In areas without a sound reinforcement system, the assistive listening system shall include a microphone system for voice input from live speakers.
- C. Assistive-Listening systems shall be provided in accordance with CBC section 11b-219 and shall comply with CBC section 11b-706.
- D. The minimum number of receivers to be provided shall be equal to 4% of the total number of seats, but in no case less than two. 25% minimum of receivers provided, but no fewer than two, shall be hearing-aid compatible in accordance with CBC Section 11B-706.3.
- E. If the system provided is limited to specific areas or seats, then such areas or seats shall be within a 50-foot viewing distance of, and have a complete view of, the stage or playing area. CBC Section 11B-219.4

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCERS

- A. Siemens Hearing Instruments, Sennheiser, Williams Sound Corporation, Gentner Communications, Phonic Ear, Audiologic Engineering, Telex Communications. The general level of quality and service provided by these producers has been determined to be acceptable; it has not been verified that the product lines of all producers listed above include devices meeting these Standards. It is the responsibility of the Design Professional to specify that the Builder is responsible to ensure that all materials proposed for use meet all requirements of these Standards.

2.02 TRANSMITTERS

- A. Transmitters shall output frequency modulated RF in the 72-76 MHz band with frequency stability and purity, deviation, power output and other characteristics as specified by the Federal Communications Commission (FCC) for unlicensed operation. Transmitter frequency deviation shall be 75 KHz nominal. Each transmitter shall have a minimum of six fixed, switch selectable,

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output frequencies. Selection shall be by use of a tool such as a screwdriver or other means designed to discourage frequency changes by unauthorized persons. Specifically describe frequency changing means in submittal. Controls shall include On-Off switch and LED type Power On indicator. Transmitter shall be suitable for continuous operation on 120 VAC 60 Hz building power. Williams T-17 is acceptable.

- B. Provide sufficient detail in the Contract Documents for proper installation of the transmitter, or require the Builder to submit sketches showing the proposed installation location and details. The Builder's proposal shall show permanent installation in a secure location and shall be approved by the University before proceeding.
- C. If the area of assembly has a sound reinforcement system, either existing or provided in the project, the transmitter shall be installed in the sound reinforcement system rack, if possible, or securely installed nearby. The Contract Documents shall not allow installation of the transmitter without providing fasteners securing it to the mounting surface, unless a specific reason not to provide fasteners is given by the Contract Documents.

2.03 RECEIVERS

- A. Pocket size rechargeable battery operated FM receiver with 1/8" or 3.5 mm earphone jack, ear bud type earphone, battery and charger. Antenna shall be internal to case or integral to the earphone cord. Separate or external antennas are not permitted. Dimensions shall not exceed 1" X 3" X 4"; weight with battery shall not exceed 4 ounces. Minimum audio output 50 mW with total harmonic distortion not exceeding 2.1% producing average SSPL90 of 135 dB or more from the earphone. Controls shall include On-Off, Volume, Channel and LED type Power On indicator. Provide automatic squelch, either manually adjustable or fixed at 10 microvolts RF input nominal. Williams PPA R7-6NA is acceptable.

2.04 RADIO FREQUENCIES

- A. The primary radio frequency in use at the University is 72.9 MHz. All systems shall operate at this frequency unless written permission is granted by the University to operate at one of the alternate frequencies of 72.1, 72.5, 74.7, 75.3 or 75.7 MHz. All receivers and transmitters shall be capable of operating on all of these frequencies with switch selection of the active frequency. Continuous tuning is not acceptable.

2.05 AUDIO FREQUENCIES

- A. System +/- 3 dB audio bandwidth, from microphone or transmitter input to earphone output, shall be 200 Hz - 8 KHz, minimum.

2.06 MICROPHONES

- A. Where a microphone system is required, provide lavalier type with cable length sufficient to reach transmitter. If the assembly area is provided with a podium, provide a microphone on the podium with a cable and plug connecting it to a flush floor jack. The floor jack shall be cable connected to the transmitter input. Microphones shall be Shure, Dukane, or other if normally provided by ALS manufacturer with ALS transmitter proposed. Floor jacks shall be locking XLR type with stainless steel trim.

2.07 WIRING

- A. Conductors shall be insulated tinned copper shielded type cables for microphone and auxiliary input circuits. Size of conductors shall be selected to minimize voltage drop and signal attenuation.

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- B. Signal wiring shall be in metallic conduit dedicated to the assistive listening or sound reinforcement system and shall not be routed with power wiring. Install and connect in conformance with the producer's recommendations and wiring diagrams. All wiring shall be identified by being tagged, numbered and terminated on terminal blocks in the cabinets, in boxes, at equipment, and at devices.

PART 3 EXECUTION AND INSTALLATION

3.01 DELIVERABLES

- A. Provide receivers and microphones to Owner prior to Substantial Completion.

3.02 ADJUSTMENTS

- A. **TESTING:** The Contract Documents shall require the Builder to deliver a complete and working system, which neither interferes with nor receives interference from other systems, whether new or existing. The Builder shall be required to thoroughly test all systems involved and obtain satisfactory operation prior to Substantial Completion. Every transmitter and receiver provided shall be individually tested for proper operation on all six radio frequencies. Interference during testing is acceptable on all frequencies except the selected active frequency. The Builder shall be required to demonstrate satisfactory operation at Substantial Completion Inspection.
- B. **ALTERNATIVE FREQUENCIES:** Adjust power output, antenna radiation patterns and other system parameters as necessary to obtain continuous squelch break, full specified receiver audio output and full quieting throughout the area served while avoiding interference with adjacent systems. If interference free operation of new and existing systems cannot be achieved with the primary frequency, an alternative frequency shall be selected from a list provided in the specifications. If interference free operation cannot be obtained using any of those frequencies, the Builder shall be required to obtain the services of an RF consulting engineer registered to practice in Florida to perform a complete frequency study of the affected area and prepare a report including certification that none of the alternative frequencies can be used and a recommendation of other alternative frequencies in the 72 - 76 MHZ band which will provide satisfactory operation. The Builder shall provide the required study and equipment operating at the selected frequency at no change in the contract amount.

END OF SECTION

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SECTION 28 31 00 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Work under this section consists of all engineering, installation labor, materials, equipment, programming, services, permits, fees and transportation necessary for, and/or reasonably incidental to, the construction and completion in working order of the work specified herein.

- B. Work includes, but is not limited to the following:
 - 1. Complete system design, engineering, testing and final acceptance by Owner and Authority having jurisdiction.
 - 2. Life safety fire alarm detection and signaling system.
 - 3. Plan check approval.
 - 4. Furnishing and installation of equipment and devices.
 - 5. Wiring in Conduit and connections.
 - 6. Interface with elevator controls.
 - 7. Programming, testing per NFPA 72, cleaning, adjusting of completed work.
 - 8. Wiring diagrams, shop drawings, equipment data.
 - 9. Complete warranty for five years. Proposal for subsequent maintenance contract including service, testing and repair or replacement.
 - 10. All work and material for complete and operable systems as indicated or specified.
 - 11. As constructed record drawings.
 - 12. Permits, inspections, fees.
 - 13. Identification and instruction in writing.
 - 14. Coordination with existing conditions and work of other trades.
 - 15. Furnishing of special back boxes for installation under electrical section.
 - 16. Extending 120- or 240-volt power from electrical panelboard, coordinating and updating load schedules with Owner.

- C. Section Includes:
 - 1. Fire-alarm control unit.
 - 2. Manual fire-alarm boxes.
 - 3. System smoke detectors.
 - 4. Air-sampling smoke detectors.
 - 5. Non-system smoke detectors.
 - 6. Heat detectors.
 - 7. Notification appliances.
 - 8. Device guards.
 - 9. Firefighters' two-way telephone communication service.
 - 10. Firefighters' smoke-control station.
 - 11. Magnetic door holders.
 - 12. Remote annunciator.
 - 13. Graphic annunciator.
 - 14. Addressable interface device.
 - 15. Digital alarm communicator transmitter.
 - 16. Radio alarm transmitter.

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17. Network communications.
18. System printer.

1.02 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. HLI: High Level Interface.
- D. NICET: National Institute for Certification in Engineering Technologies.
- E. PC: Personal computer.
- F. VESDA: Very Early Smoke-Detection Apparatus.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product, including furnished options and accessories.
 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
 2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Product Samples: For each device provide product sample for color and product review.
- C. Shop Drawings: For fire-alarm system.
 1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 2. Include plans, elevations, sections, details, and attachments to other work.
 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
 4. Detail assembly and support requirements.
 5. Include voltage drop calculations for notification-appliance circuits.
 6. Include battery-size calculations.
 7. Include input/output matrix.
 8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
 9. Include performance parameters and installation details for each detector.
 10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
 12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

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- a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
 - b. Show field wiring required for HVAC unit shutdown on alarm.
 - c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.
 - d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
 - e. Locate detectors according to manufacturer's written recommendations.
 - f. Show air-sampling detector pipe routing.
 13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
 14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.
 15. Extend 120-volt power from electrical panelboard, coordinating and updating load schedules with Owner.
- D. General Submittal Requirements:
1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
 2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified, fire-alarm technician; Level III minimum.
 - c. Licensed or certified by authorities having jurisdiction.
- E. For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Include in the Fire Alarm System submittal all the following information submitted as a complete package for review by the inspection agency. The contractor may submit to Architect concurrently if prior written approval for concurrent submission is obtained from the Architect. Approval by the authority having jurisdiction does not constitute acceptance by the Architect for device locations. Submit within 30 working days of award of contract. Incremental submittals at 50%, 90% and 100% completion are acceptable if proposed scope and schedule for each submittal is accepted by the Architect. Proposed scope must be submitted within 10 working days of award of contract.
1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
 3. Indicate audible appliances required to produce square wave signal per NFPA 72.
 4. Prepare complete plans, risers, wiring diagrams, and installation drawings, coordinated with the work of other trades, for the fire alarm system stamped by a registered engineer where required by the inspecting agencies.
 5. Plans shall be prepared under the supervision of a qualified technician who is experienced with the type of work specified herein and is currently certified by the

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- National Institute for Certification in Engineering Technologies (NICET) as an engineering technician with minimum level III certification.
6. Obtain governing agency approval for fire alarm system after submitting shop drawings and before installing any portion of the system.
 7. Obtain and incorporate Architectural and Owners review comments and submit modifications to authority having jurisdiction for final approval, bring any conflicts to the Architects and Owners attention. Install system per reviewed shop drawings.
- F. Administrative
1. Permit application
 2. Pay all plan review and inspection fees
 3. Include the following installing contractor's information:
 - a. Installing contractors name, address phone number.
 - b. Contractor's license number.
 - c. Local business license number.
 - d. Include a copy of workers compensation insurance certificate.
 - e. Evidence of Contractor personnel NICET Certification.
 - f. List of contractor's personnel who will be working on the installation.
 4. Include the following Project information:
 - a. Site address.
 - b. Basis for installation / Building code occupancy classification.
- G. Fire alarm equipment
1. Include manufacturers specification sheets for all components
 2. Identify equipment application per listing and approvals
 3. Include CSFM listing sheets for all required systems and components numbers
- H. General information
1. Indicate appropriate codes and standards, including reference edition.
 2. Indicate type of system or service involved.
 3. Include written sequence of operation or matrix table.
 4. Indicate HVAC equipment locations and CFM.
 5. Indicate any special system features or operations.
 6. Indicate all required identification and labeling. Include locations for each item and proposed nomenclature.
- I. Plans and details
1. Include the following information:
 - a. Scaled reflected ceiling and floor plans, including north reference.
 - b. Completed title block indicating project site address and installing contractors address.
 - c. Identify each room and its proposed use.
 - d. Locate all devices, cabinets and components including end of line devices.
 - e. Accurate legend of symbols for all fire alarm devices being installed, conforming with construction documents.
 - f. Identify circuit styles, designations and methods.
 - g. Include building cross sections, include attic, soffit or ceiling details.
 - h. Indicate location of sprinkler system test valve.

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- i. Include voltage drop calculations.
 - j. Include description of zone assignments / device addresses.
 - k. Indicate through penetration fire stopping details and specifications.
 - l. Include reflected ceiling plans showing duct diffusers, lighting fixtures, sprinklers, ceiling types and changes in elevations. Locate all fire alarm ceiling mounted devices in relation to work of other trades and other ceiling components.
 - m. Elevation detail of manual pull station installation and visual alarm signaling devices. Note that existing device mounting heights and locations may not comply with current codes.
 - n. Indicate device mounting heights coordinated with architectural elevations for wall mounted initiation and notification devices.
 - o. Include power supply source and details.
- J. Riser diagram
 - 1. Indicate conductor information:
 - a. Size.
 - b. Stranding.
 - c. Insulation type.
 - 2. Identification of wire quantities and conduit or raceway sizes.
 - 3. Include conduit fill calculations.
 - 4. Indicate locations for end of line devices
- K. Additional requirements
 - 1. Point-to-point wiring diagrams for overall system and components, including 120-volt power distribution and interface with the HVAC and fire protection systems.
 - 2. Typical device wiring diagrams.
 - 3. Battery calculations to meet AHJ minimum hour requirements.
 - 4. Details for support and anchorage of all fire alarm equipment weighing over 20 pounds.
 - 5. Include physical and electrical characteristics of equipment to indicate conformance with the specifications.
 - 6. Annunciator configuration and designations.
 - 7. Revised panel schedules showing 120-volt circuit loads.
 - 8. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
 - 9. Device Address List: Coordinate with final system programming.
 - 10. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - 11. Ductwork Coordination Drawings: Plans, sections, and elevations of ducts, drawn to scale and coordinating the installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, the detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.

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12. Audible/visual/Alarm Signaling Service: Equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Seismic Qualification Data: Certificates, for fire-alarm control unit, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.05 SAMPLE WARRANTY: FOR SPECIAL WARRANTY.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:
 - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
 - d. Riser diagram.
 - e. Device addresses.
 - f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
 - g. Record copy of site-specific software.
 - h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
 - 1) Equipment tested.
 - 2) Frequency of testing of installed components.
 - 3) Frequency of inspection of installed components.
 - 4) Requirements and recommendations related to results of maintenance.
 - 5) Manufacturer's user training manuals.
 - i. Manufacturer's required maintenance related to system warranty requirements.

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- j. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

- B. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.

1.07 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. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
 2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
 3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
 4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
 5. Keys and Tools: One extra set for access to locked or tamper-proofed components.
 6. Audible and Visual Notification Appliances: One of each type installed.
 7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.
 8. Filters for Air-Sampling Detectors: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
 9. Air-Sampling Fan: Quantity equal to one for every five detectors, but no fewer than one unit of each type.

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level IV technician.
- C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).
- D. NFPA Certification: Obtain certification according to NFPA 72 by a UL listed alarm company.
- E. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.

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- F. NFPA Certification: Obtain certification according to NFPA 72 by

1.09 PROJECT CONDITIONS

- A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.

1.10 SEQUENCING AND SCHEDULING

- A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
 2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Automatic sensitivity control of certain smoke detectors.
- B. All components provided shall be listed for use with the selected system.
- 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.

2.02 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices. Retain only those devices and systems in subparagraphs below applicable to Project. Coordinate with requirements in other Sections that specify listed devices and systems.
1. Manual stations.
 2. Heat detectors.
 3. Smoke detectors.
 4. Duct smoke detectors.
 5. Carbon monoxide detectors.
 6. Automatic sprinkler system water flow.

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7. Fire-extinguishing system operation.
 8. Fire standpipe system.
 9. Dry system pressure flow switch.
- B. Fire-alarm signal shall initiate the following actions:
1. Continuously operate alarm notification appliances including voice evacuation notices.
 2. Identify alarm and specific initiating device at fire-alarm control panel, connected network control panels, off-premises network control panels, and remote annunciators.
 3. Transmit an alarm signal to the remote alarm receiving station.
 4. Unlock electric door locks in designated egress paths.
 5. Release fire and smoke doors held open by magnetic door holders.
 6. Activate voice/alarm communication system.
 7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 8. Activate smoke-control system (smoke management) at firefighters' smoke-control system panel.
 9. Activate stairwell and elevator-shaft pressurization systems.
 10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 11. Recall elevators to primary or alternate recall floors.
 12. Activate elevator power shunt trip.
 13. Activate emergency lighting control.
- C. or more of the following devices and actions:
1. Valve supervisory switch.
 2. Alert and Action signals of air-sampling detector system.
 3. Elevator shunt-trip supervision.
 4. Independent fire-detection and -suppression systems.
 5. User disabling of zones or individual devices.
 6. Loss of communication with any panel on the network.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
 4. Loss of primary power at fire-alarm control unit.
 5. Ground or a single break in internal circuits of fire-alarm control unit.
 6. Abnormal ac voltage at fire-alarm control unit.
 7. Break in standby battery circuitry.
 8. Failure of battery charging.
 9. Abnormal position of any switch at fire-alarm control unit or annunciator.
 10. Voice signal amplifier failure.
- E. System Supervisory Signal Actions:
1. Initiate notification appliances.

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2. Identify specific device initiating the event at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
3. Record the event on system printer.
4. After a time-delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
5. Display system status on graphic annunciator.

2.03 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.04 FIRE-ALARM CONTROL UNIT

- A. Manufacturers: Subject to compliance with requirements, system shall be the following:
 1. Simplex/JCI
- B. General Requirements for Fire-Alarm Control Unit:
 1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
 - a. System software and programs shall be held in non-volatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 - c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
 - d. The FACP shall be listed for connection to a central-station signaling system service.
 - e. Provide non-volatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
 2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
 3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.
- C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 1. Annunciator and Display: Liquid-crystal type, two line(s) of 80 characters, minimum.

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2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
- D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
1. Pathway Class Designations: NFPA 72, Class B.
 2. Pathway Survivability: Level 0.
 3. Install no more than 50 addressable devices on each signaling-line circuit.
 4. Serial Interfaces:
 - a. One dedicated RS 485 port for remote station operation using point ID DACT.
 - b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
 - c. One USB port for PC configuration.
 - d. One RS 232 port for voice evacuation interface.
- E. Smoke-Alarm Verification:
1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
 3. Record events by the system printer.
 4. Sound general alarm if the alarm is verified.
 5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- F. Notification-Appliance Circuit:
1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
 2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
 3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
- G. Elevator Recall:
1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:
 - a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.
 - c. Smoke detectors in elevator hoistway.
 2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
 3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
 - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
- H. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.

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- I. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory and print out the final adjusted values on system printer.
- J. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- K. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in a separate cabinet located in the fire command center.
 - 1. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711.
 - a. Allow the application of, and evacuation signal to, indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
 - b. Programmable tone and message sequence selection.
 - c. Standard digitally recorded messages for "Evacuation" and "All Clear."
 - d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control panel.
 - 2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
 - 3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
- L. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- M. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters and alarm radio transmitters shall be powered by 24-V dc source.
 - 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- N. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Sealed lead calcium.

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- O. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.05 MANUAL FIRE-ALARM BOXES

- A. Manufacturers:
1. Simplex/JCI
- B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 2. Station Reset: Key- or wrench-operated switch.
 3. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.06 SYSTEM SMOKE DETECTORS

- A. Manufacturers:
1. Simplex/JCI
- B. General Requirements for System Smoke Detectors:
1. Comply with UL 268; operating at 24-V dc, nominal.
 2. Detectors shall be four-wire type.
 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 6. Integral Visual-Indicating Light: LED type, indicating detector has operated power-on status.
 7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
- C. Photoelectric Smoke Detectors:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.

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- b. Device type.
- c. Present average value.
- d. Present sensitivity selected.
- e. Sensor range (normal, dirty, etc.).

D. Ionization Smoke Detector:

- 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
- 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

E. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

- 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
- 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- 3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
- 4. Each sensor shall have multiple levels of detection sensitivity.
- 5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
- 6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.07 HEAT DETECTORS

A. Manufacturers:

- 1. Simplex/JCI

B. General Requirements for Heat Detectors: Comply with UL 521.

- 1. Temperature sensors shall test for and communicate the sensitivity range of the device.

C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.

- 1. Mounting: Adapter plate for outlet box mounting Twist-lock base interchangeable with smoke-detector bases.

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2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
- D. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F
1. Mounting: Adapter plate for outlet box mounting] [Twist-lock base interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.08 NOTIFICATION APPLIANCES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Simplex/JCI
 2. System Sensor
 3. Wheelock; a brand of Eaton
- B. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
- C. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- D. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1 inch (25mm) high letters on the lens.
1. Rated Light Output:
 - a. 153075110] [177] cd.
 - b. 15/30/75/110 cd, selectable in the field.
 2. Mounting: Wall mounted unless otherwise indicated.
 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 4. Flashing shall be in a temporal pattern, synchronized with other units.
 5. Strobe Leads: Factory connected to screw terminals.
 6. Mounting Faceplate: Factory finished, red
- E. Voice/Tone Notification Appliances:
1. Comply with UL 1480.
 2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
 3. High-Range Units: Rated 2 to 15 W.
 4. Low-Range Units: Rated 1 to 2 W.

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5. Mounting: Flush
6. Matching Transformers: Tap range matched to acoustical environment of speaker location.

F. Exit Marking Audible Notification Appliance:

1. Exit marking audible notification appliances shall meet the audibility requirements in NFPA 72.
2. Provide exit marking audible notification appliances at the entrance to all building exits.
3. Provide exit marking audible notification appliances at the entrance to areas of refuge with audible signals distinct from those used for building exit marking.

2.09 FIREFIGHTERS' TWO-WAY TELEPHONE COMMUNICATION SERVICE

- A. Dedicated, two-way, supervised, telephone voice communication links between fire-alarm control panel, the fire command center and remote firefighters' telephone stations. Supervised telephone lines shall be connected to talk circuits by controls in a control module. Provide the following:
1. Common-talk type for firefighter use only.
 2. Selective-talk type for use by firefighters and fire wardens.
 3. Controls to disconnect phones from talk circuits if too many phones are in use simultaneously. An indicator lamp shall flash if a phone is disconnected from the talk circuits.
 4. Addressable firefighters' phone modules to monitor and control a loop of firefighter phones. Module shall be capable of differentiating between normal, off-hook, and trouble conditions.
 5. Audible Pulse and Tone Generator, and High-Intensity Lamp: When a remote telephone is taken off the hook, it causes an audible signal to sound and a high-intensity lamp to flash at the fire-alarm control panel fire command center.
 6. Selector panel controls to provide for simultaneous operation of up to six telephones in selected zones. Indicate ground faults and open or shorted telephone lines on the panel front by individual LEDs.
 7. Display: Graphic to indicate location of caller.
 8. Remote Telephone Cabinet: Flush- or surface-mounted cabinet as indicated, factory-standard red finish, with handset.
 - a. Install one-piece handset to cabinet with vandal-resistant armored cord. Silk-screened or engraved label on cabinet door, designating "Fire Warden Phone" or "Fire Emergency Phone."
 - b. With "break-glass" type door access lock.
 9. Remote Telephone Jack Stations: Single-gang, stainless-steel-plate mounted plug, engraved "Fire Warden Phone" or "Fire Emergency Phone."
 10. Handsets: push-to-talk-type sets with noise-canceling microphone stored in a cabinet adjacent to fire-alarm control panel in the fire command center.

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2.10 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 - 1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.11 ADDRESSABLE INTERFACE DEVICE

- A. General:
 - 1. Include address-setting means on the module.
 - 2. Store an internal identifying code for control panel use to identify the module type.
 - 3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall to circuit-breaker shunt trip for power shutdown.
 - 1. Allow the control panel to switch the relay contacts on command.
 - 2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

2.12 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a pre-set number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. Primary line shall be cellular communication, and secondary line is telephone (POTS) line. If service is lost on cellular signal or telephone line, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
 - 1. Verification that both telephone lines are available.
 - 2. Programming device.
 - 3. LED display.

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4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.13 RADIO ALARM TRANSMITTER

A. Transmitter shall comply with NFPA 1221 and 47 CFR 90.

B. Description: Manufacturer's standard commercial product; factory assembled, wired, and tested; ready for installation and operation.

1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
3. Normal Power Input: 120-V ac.
4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
5. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph with a gust factor of 1.3 without failure.
6. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
7. Antenna-Cable Connectors: Weatherproof.
8. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.

C. Functional Performance: Unit shall receive alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:

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1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
6. Local Fire-Alarm-System, Supervisory-Alarm Message: [Actuated when the building alarm system indicates a supervisory alarm] <Insert condition>.

2.14 NETWORK COMMUNICATIONS

- A. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.
- B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.
- C. Provide integration gateway using BACnet Modbus for connection to building automation system.

2.15 SYSTEM PRINTER

- A. Printer shall be listed and labeled as an integral part of fire-alarm system.

2.16 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 1. Factory fabricated and furnished by device manufacturer.
 2. Finish: Paint of color to match the protected device.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

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- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
 - 1. Devices placed in service before all other trades have completed cleanup shall be replaced.
 - 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Equipment Mounting: Install fire-alarm control unit on concrete base. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete." Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."
 - 1. Install seismic bracing. Comply with requirements in Section 27 05 48.16 "Seismic Controls for Communications Systems."
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (460-mm) centers around the full perimeter of concrete base.
 - 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Equipment Mounting: Install fire-alarm control unit on finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 27 05 48.16 "Seismic Controls for Communications Systems."
- D. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 27 05 48.16 "Seismic Controls for Communications Systems."
- E. Manual Fire-Alarm Boxes:
 - 1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
 - 2. Mount manual fire-alarm box on a background of a contrasting color.
 - 3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.
 - 4. Pull Station can be either single or dual action.

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- F. Smoke- or Heat-Detector Spacing:
1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
 2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
 3. Smooth ceiling spacing shall not exceed 30 feet (9 m)
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
 5. HVAC: Locate detectors not closer than 36 inches (910 mm), 60 inches (1520 mm) from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.
- G. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- H. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends.
1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- I. Air-Sampling Smoke Detectors: If using multiple pipe runs, the runs shall be pneumatically balanced.
- J. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
- K. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- L. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- M. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- N. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.
- O. Device Location-Indicating Lights: Locate in public space near the device they monitor.

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- P. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists 100-mph (160-km/h) load with a gust factor of 1.3 without damage.

3.03 PATHWAYS

- A. Pathways above recessed ceilings and in non-accessible locations may be routed exposed.
- Exposed pathways located less than 96 inches (2440 mm) above the floor shall be installed in EMT.
- B. Pathways shall be installed in EMT.
- C. Exposed EMT shall be painted red enamel.
- D. Riser cabling shall be in 2 hour rated enclosure and must be FPLR cable type.
- E. Where allowable by AHJ, per CBC riser cabling not installed in 2 hour rated enclosure shall be "Class A" (redundant) style wiring.

3.04 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 08 71 00 "Door Hardware." Connect hardware and devices to fire-alarm system.
- Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
- Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
 - Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
 - Smoke dampers in air ducts of designated HVAC duct systems.
 - Magnetically held-open doors.
 - Electronically locked doors and access gates.
 - Alarm-initiating connection to elevator recall system and components.
 - Alarm-initiating connection to activate emergency lighting control.
 - Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 - Supervisory connections at valve supervisory switches.
 - Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 - Supervisory connections at elevator shunt-trip breaker.
 - Data communication circuits for connection to building management system.
 - Data communication circuits for connection to mass notification system.
 - Supervisory connections at fire-extinguisher locations.

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15. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
16. Supervisory connections at fire-pump engine control panel.

3.05 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 27 05 53 "Identification for Communications Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.06 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.07 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.

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6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semi-annual periods. Use forms developed for initial tests and inspections.
- I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.08 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.09 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

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1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

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SECTION 31 10 00 – SITE CLEARING

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. Additional information concerning earthwork may be found in the geotechnical investigation report; Geotechnical Design Geological Hazards Evaluation Report Horticultural Center Merritt College, August 7th, 2020 by Terraphase Engineering, available by request. All requirements of this report shall be followed unless noted otherwise.
- C. Stormwater Pollution Prevention Plan (SWPPP) prepared by the Contractor, refer to Section 00 73 13 – Special Conditions.

1.2 SUMMARY

- A. This Section Includes:
 - 1. Protecting existing trees and other vegetation to remain.
 - 2. Clearing and grubbing.
 - 3. Stripping and stockpiling topsoil.
 - 4. Removing above- and below-grade site improvements.
- B. Related Sections:
 - 1. Section 00 73 13 – Special Conditions
 - 2. Section 01 56 39 – Temporary Tree and Plant Protection, for protection of existing plants
 - 3. Section 02 41 13 – Selective Site Demolition
 - 4. Section 02 41 19 – Landscape Selective Demolition
 - 5. Section 31 22 00 – Earthwork and Grading
 - 6. Section 31 25 00 – Erosion and Sedimentation Control
 - 7. Section 32 91 13 – Soil Preparation

1.3 REFERENCES

- A. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where cited in this Section. Use applicable year of adoption or revision as published in the 2018 "Annual Book of ASTM Standards".
- B. Earthwork materials and methods of construction shall be in accordance with referenced sections of the latest revision of the Standard Specifications of the State of California Department of Transportation (Caltrans), 2018 edition.

1.4 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of subsoil and weeds, roots, sticks, construction debris,

toxic materials, or other non-soil materials. Refer to Section 01 56 39 – Temporary Tree and Plant Protection for additional requirements.

- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated. Refer to Section 01 56 39 – Temporary Tree and Plant Protection for additional requirements.
- C. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called “topsoil,” but in disturbed areas such as urban environments, the surface soil can be subsoil.
- D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs or other vegetation to be protected during construction and indicated on Drawings.

1.5 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site. See Section 02 41 19 for additional requirements.

1.6 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain on project site property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.7 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing. Refer to Section 02 41 19 – Selective Landscape Demolition for documentation requirements.

1.8 QUALITY ASSURANCE

- A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.
- B. Boulder Stockpiling Program: Prepare a diagram of locations of all on-site boulders 24” in any dimension or larger and proposed stockpile location.

1.9 SITE CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing and earthwork operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the District.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by the District.
- B. Utility Locator Service: Notify utility locator service (Underground Service Alert for utilities located within project site).

- C. Do not commence site clearing operations until temporary erosion and sedimentation control measures and tree protection measures specified in Section 01 56 39 Temporary Tree and Plant Protection and Section 00 73 13 Special Conditions as applicable are in place.
- D. Salvable Improvements: Carefully remove items indicated to be salvaged or removed and reinstalled in coordination with the District's Representative.

1.10 FIELD CONDITIONS

- A. Soil Test: Refer to Section 32 91 13 – Soil Preparation.
- B. Carefully remove items indicated on Drawings to be removed and reinstalled or salvaged and store on the District's premises where indicated.
- C. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.
 - 1. Refer to Erosion and Sediment Control Plan by Civil Engineers.
 - 2. Coordinate plant protection with Landscape Architect during preconstruction meetings.
- D. Tree- and Plant-Protection Zones: Protect according to requirements in Section 01 56 39 – Temporary Tree and Plant Protection.
- E. Soil Stripping, Handling and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 22 00 – Earthwork and Grading.
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on site.
- B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #23 surface-tolerant, anticorrosive metal primer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction
- B. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to the District.
- C. Verify that trees, shrubs and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 01 56 39 – Temporary Tree and Plant Protection.

- D. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, at no additional cost and as acceptable to the District.

3.2 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site according to requirements in Section 01 56 39 – Tree Protection.
- B. Where excavation for new construction is required within tree protection zones, Contractor to follow procedures provided in Section 01 56 39 – Temporary Tree and Plant Protection.

3.3 CLEARING AND GRUBBING

- A. Remove obstructions, including pavements, trees, shrubs, grass, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Chip removed tree branches, trunks, stumps and smaller vegetation and dispose of off-site to an approved composting facility.
- B. Holes resulting from the removal of trees, underground structures, or improvements that extend below the finish grades should be cleared thoroughly. If the holes do not extend below the bearing elevation of footings, they should be backfilled with suitable material compacted per Section 31 20 00, or as required by the Geotechnical Engineer.

3.4 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
 - 2. Removed subsoil shall be transported to a soil stockpile and transfer facility where it can be reused on other projects as fill.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and prevent to and from stockpile by means of erosion control products used for similar purposes per erosion control plan.
 - 1. Limit height of topsoil stockpiles to 72 inches.
 - 2. Do not stockpile topsoil within tree protection zones.
 - 3. Stockpile surplus topsoil to allow for re-spreading.

3.5 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated on Demolition Plan and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

- C. Refer to Section 02 41 13 – Selective Site Demolition and Selection 02 41 19 – Landscape Selective Demolition.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Refer to Section 01 74 19 – Selective Site Demolition and Section 02 41 19 – Landscape Selective Demolition.
- B. Do not dispose of rock material naturally occurring on site. See Section 31 22 00 – Earthwork and Grading.
- C. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off project site property.
 - 1. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.
 - 2. Document quantities of disposed and recycled material transported per CalGreen requirements.

END OF SECTION

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SECTION 31 22 00 – EARTHWORK AND GRADING

PART 1 GENERAL

1.01 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. Additional information concerning earthwork may be found in the geotechnical investigation report, Geotechnical Design and Geological Hazards Evaluation Report, prepared on August 07, 2020 by Terraphase Engineering Inc, available by request. All requirements of this report shall be followed unless noted otherwise.

1.02 SUMMARY

- A. Section Includes:
 - 1. Backfilling adjacent to building perimeter to subgrade elevations.
 - 2. Backfilling site structures to subgrade elevations.
 - 3. Fill under slabs-on-grade and foundations.
 - 4. Fill under paving.
 - 5. Fill for over-excavation.
 - 6. Excavation.
 - 7. Dewatering.
 - 8. General Filling and backfilling.
 - 9. Grading.
- B. Related Sections:
 - 1. Section 31 23 33 – Utility Trenching and Backfilling.
 - 2. Section 31 63 29 – Drilled Concrete Piers and Shafts
- C. Definitions
 - 1. Backfill: Material used to fill an excavation.
 - 2. Dewatering: Removal of all standing water as well as water seeping into an excavation to maintain conditions suitable to continue the Work. Dewatering activities normally include over-excavation and placement of drain rock within an excavation to support required activities and/or equipment. The Contractor is responsible to maintain conditions suitable for the ongoing work at no additional cost to the District.
 - 3. Foundation Rock Fill: Coarse, well-draining rock used to fill over-excavated areas, particularly in soft soils or where groundwater may be present, to bring the grade up to indicated elevation. Also referred to as "Drain Rock".
 - 4. Imported Fill: Suitable material that must be transported to the site due to inadequate availability of suitable native fill.
 - 5. Select Material: Non-expansive soil material that is free from organic matter, debris and clumps, stones or clods larger than 3" as described in this Specification.
 - 6. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill upon which base or subbase material or constructed works are placed.

7. Suitable Material: Soil material that meets the required specifications for its intended purpose as described in this Specification and on the Drawings and in the Geotechnical Report.
8. Native Backfill: Native Soil that has been excavated on-site, identified as meeting the requirements for use as a backfill material. It has had all organic material, rocks of unacceptable size, and any other deleterious material removed, and has been protected from contamination while being stockpiled on site.
9. Surplus Material: Excavated native material in excess of the project requirements. Surplus Material shall be placed on site in locations and to the grades and compaction requirements of the geotechnical engineer. Excess material to be moved to off-site campus location at the direction of the District.
10. Topsoil: The nutrient rich upper layer of soil suitable for landscape plantings. Topsoil material may have organic content per Landscape Specifications.
11. Unauthorized Excavation: Removal of material, whether suitable or unsuitable material, beyond the excavation limits of the design.
12. Undisturbed Native Soil: Natural soil material as it exists in situ without being turned, graded, scratched or in any way disturbed.
13. Unsuitable Material: Any material that does not meet the required specifications for its intended purpose.

1.03 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 1. ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils.
 2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³).
 3. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³).
 5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 6. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 7. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.04 SUBMITTALS

- A. Samples: Submit, in air-tight containers, 10 lb (4.5 kg) sample of each type of fill to testing laboratory.
- B. Materials Source: Submit name of imported fill materials suppliers.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.05 PERFORMANCE REQUIREMENTS

A. Design dewatering systems to:

1. Lower water table within areas of excavation to minimum 1-foot below bottom of excavation to permit Work to be completed on dry and stable subgrade.
2. Relieve hydrostatic pressures in confined water bearing strata below excavation to eliminate risk of uplift or other instability of excavation.
 - a. Prevent damage to adjacent properties, buildings, structures, utilities, and facilities from construction operations.
 - b. Prevent loss of fines, quick condition, or softening of foundation subgrade.
 - c. Maintain stability of sides and bottoms of excavations and trenches, face/walls/bottoms of tunnels, and sides and bottoms of shafts.

1.06 QUALITY ASSURANCE

A. Requirements for Regulatory Agencies:

1. Comply with State of California Business and Transportation Agency, California Department of Transportation (CDT, Caltrans) "Standard Specifications" (Caltrans Standard Specification).
2. Comply with State of California Code of Regulations (CCR).
3. Comply with State of California Construction Safety Orders, Latest Edition (CAL/OSHA).
4. Peralta Community College District Standards and Specifications, Codes and Requirements
5. Maintain one copy of each document on site.

B. Soil Testing:

1. District will engage a geotechnical testing agency, to include testing soil materials proposed for use in the work and for quality control testing during excavation and fill operations.
2. Make field observations and tests to enable the Testing Lab to form opinions regarding adequacy of site preparation, acceptability of fill materials and extent to which earthwork construction and relative compaction comply with specifications requirements.
3. All compaction tests and final grading report shall be submitted to the District prior to scheduling inspections.
4. Examine conditions exposed in foundation excavations.

C. Geotechnical Engineering Services:

1. Geotechnical Engineer shall be provided by the District, to observe and test grading excavation and compaction of fill materials.
2. Make field observations and tests to enable him or her to form opinions regarding adequacy of site preparation, acceptability of fill materials and extent to which earthwork construction and relative compaction comply with specifications requirements.

1.07 DELIVERY, STORAGE AND HANDLING

- A. All soils materials, stockpiled on site shall be protected from excessive moisture, including from rain or surface sources.
- B. All soils materials stockpiled on site shall be protected from erosion and discharge to drainage structures. Soils shall also be protected from wind erosion.
- C. Stockpiled materials of different types shall be maintained separately and not allowed to mix.

- D. Comply with provisions of Section 01 50 00 – TEMPORARY FACILITIES AND CONTROLS where necessary to control dust and noise on and near the work caused by operations during performance of the Work.

1.08 PROJECT CONDITIONS

- A. Review the project geotechnical report for the following:
1. The character of the material to be used.
 2. Ground water elevations.
- B. Environmental Requirements:
1. Comply with the local erosion and sediment control requirements.
 2. The contractor is responsible for completion of the Work in compliance with these Specifications regardless of the weather or presence of groundwater.
- B. Protections of open excavations.
1. Comply with requirements of Section 01 50 00 TEMPORARY FACILITIES AND CONTROLS.
 2. It is the Contractor's responsibility to safeguard his employees and the public from hazards related to open trenches or excavations, per the requirements of Division 01.
- C. Protection of Subgrade
1. Protection of Subgrade: Do not allow equipment to pump or rut subgrade, stripped areas, footing excavations, or other areas prepared for project
 2. At Contractor's option, a working pad of granular material may be laid to protect footing and floor subgrade soils from disruption by traffic during wet conditions.
- D. Transport of soils.
1. Transport all excess soils materials by legally approved methods to disposal areas.
 2. Coordinate with the District's Representative.
 3. Sufficient topsoil and fill material shall be retained from the site to complete project requirements.
 4. Any additional topsoil and fill requirements shall be the responsibility of the Contractor.

1.09 SEQUENCING AND SCHEDULING

- A. The schedule of operations shall be reviewed by the District's Representative prior to commencement of any work.
- B. Coordinate operations with other construction activities, such as relocation of existing utilities.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General Requirements:
1. Fill material will be subject to approval of the Geotechnical Engineer.
 2. For approval of imported fill material, notify the District's Representative at least 7 days in advance of intention to import material, designated proposed borrow area, and permit the

Geotechnical Engineer to sample as necessary from borrow area for purpose of making acceptance tests to prove quality of material.

3. Consult the Geotechnical Engineer to determine the suitability of these soils.
- B. Engineered Fill Material: Soil excavated from site (native) or imported conforming to requirements for fill material contained in geotechnical report.
- C. Native Fill: Approved native materials shall have a plasticity index between 5 and 15, an expansion index not exceeding 20 as determined by UBC Specification 29-2, and a particle size not exceeding 3 inches as determined by ASTM D422.
- D. Imported Fill: Imported fill shall be non-expansive granular soil, free of organic matter and debris, and have a maximum Plasticity Index of 12 and a maximum Liquid Limit specified by the geotechnical engineer. Refer to geotechnical report.
- E. Imported Fill for Planting Areas: Imported fill for use in planting areas shall be sandy loam weed free soil. Submit analysis from certified Soil and Plant Lab. Coordinate with Landscape Architect.
- F. Sand: Clean, well-graded fine to coarse sand with not more than 2 percent passing the #200 sieve based on wet sieve analysis.
- G. Foundation Rock Fill: Foundation Rock Fill shall consist of Class 2 Crushed Rock Aggregate Base, per Caltrans Specifications. At the Contractor's discretion, either ¾-inch Ag Base or 1 ½-inch Aggregate Base is acceptable.
- H. Biotreatment Soil: To be per County of Alameda C.3 Provisions.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with approved fill and compact to density equal to or greater than requirements for subsequent fill material.
- C. Scarify subgrade surface to depth of 8 inches.
- D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.2 DEWATERING

1. Provide dewatering systems to:

- a. Lower water table within areas of excavation to minimum **1 foot (305 mm)** below bottom of excavation to permit Work to be completed on dry and stable subgrade.
- b. Relieve hydrostatic pressures in confined water bearing strata below excavation to eliminate risk of uplift or other instability of excavation.
 - 1) Prevent damage to adjacent properties, buildings, structures, utilities, and facilities from construction operations.
- c. Prevent loss of fines, quick condition, or softening of foundation subgrade.

- d. Maintain stability of sides and bottoms of excavations and trenches, face/walls/bottoms of tunnels, and sides and bottoms of shafts.

3.3 EXCAVATION

- A. Underpin adjacent structures which may be damaged by excavation work.
- B. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving, and site structures.
- C. Slope banks with machine to angle of repose or less until shored
- D. Do not interfere with 45 degree bearing splay of foundations.
- E. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- F. Trim excavation. Remove loose mat
- G. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume.
- H. Notify Engineer of unexpected subsurface conditions.
- I. Correct areas over excavated with suitable material and as directed by Owner's Representative.
- J. Remove excess and unsuitable material from site.
- K. Repair or replace items indicated to remain, damaged by excavation.

3.4 BACKFILLING AND COMPACTING

- A. Backfill areas to contours and elevations with unfrozen materials.
- B. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place material in continuous layers as follows
 - 1. Maximum 8 inches compacted depth.
- D. Employ placement method that does not disturb or damage other work.
- E. Maintain optimum moisture content of backfill materials to attain required compaction density.
- F. Do not backfill against unsupported foundation walls.
- G. Slope grade away from building minimum 2 percent.
- H. Make gradual grade changes. Blend slope into level areas.
- I. Remove surplus backfill materials from site.
- J. Leave fill material stockpile areas free of excess fill materials.
- K. Compact as required in geotechnical report.

3.5 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.
- C. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

3.6 FIELD QUALITY CONTROL

- A. Refer to Division 1 for field inspecting, testing, adjusting, and balancing.
- B. Perform laboratory material tests in accordance with ASTM D1557, ASTM D698, or AASHTO T180, as applicable
- C. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.
- D. Perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D6938, whichever is applicable
 - 2. Moisture Tests: ASTM D6938.
- E. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- F. Frequency of Tests as determined by Geotechnical Engineer:

3.7 PROTECTION

- A. Refer to Division 1 for protecting finished work.
- B. Protect newly graded areas from traffic and erosion. In unpaved areas without landscaping, cover with straw erosion control blanket. Follow manufacturer's recommendations for installation. Provide and place straw wattles or biodegradable fiber logs across the slope at the midpoint and along the downhill edge of site. No soil is to be left uncovered at the completion of construction. Keep free of trash and debris.
- C. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION

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SECTION 31 23 33 – TRENCHING, BACKFILLING AND COMPACTING

PART 1 GENERAL

1.01 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. Additional information concerning earthwork may be found in the geotechnical investigation report, Geotechnical Design and Geological Hazards Evaluation Report, prepared by Terraphase Engineering on August 07, 2020, available by request. All requirements of this report shall be followed unless noted otherwise.

1.02 SUMMARY

- A. Section includes:
 - 1. Trench Excavation
 - 2. Bedding Material
 - 3. Select Backfill Material
 - 4. Foundation Rock Fill Material
 - 5. Geotextile Filter Fabric
- B. Section excludes:
 - 1. Drainage fill material and placement around perforated underdrains and perimeter drains.
 - 2. Power, telecommunications, and low voltage scope of work.
- C. Related Sections:
 - 1. Section 01 56 39 – TEMPORARY TREE AND PLANT PROTECTION
 - 2. Section 31 22 00 – EARTHWORK AND GRADING
 - 3. Section 33 10 00 – SITE WATER SYSTEMS
 - 4. Section 33 30 00 – SITE SANITARY SEWER
 - 5. Section 33 40 00 – SITE STORM DRAINAGE SYSTEMS
- D. Definitions
 - 1. Backfill: Material used to fill an excavation.
 - 2. Bedding: Well-draining material placed on the excavated subgrade in a trench upon which pipes or other elements of the Work is placed.
 - 3. Controlled Density Fill (CDF): CDF shall consist of a fluid, workable mixture of aggregate, cement and water.
 - 4. Dewatering: Removal of all standing water as well as water seeping into an excavation to maintain conditions suitable to continue the Work. Dewatering activities normally include over-excavation and placement of drain rock within an excavation to support required activities and/or equipment. The Contractor is responsible to maintain conditions suitable for the ongoing work.
 - 5. Foundation Rock Fill: Coarse, well-draining rock used to fill over-excavated areas, particularly in soft soils or where groundwater may be present, to bring the grade up to indicated elevation. Also referred to as "Drain Rock".
 - 6. Imported Fill: Suitable material that must be transported to the site due to inadequate availability of suitable native fill.
 - 7. Over-Excavation: Removal of unsuitable material below the design depth of the excavation.

8. Pipe Zone: The area within a pipe trench wherein the pipe is considered to be particularly vulnerable to external forces. Generally, the pipe zone is described as from the bottom of the bedding layer to approximately an equal distance above the pipe. Upper and lower limits of the pipe zone are indicated on the Drawings and varies depending upon the size and material of the pipe. Where not otherwise indicated, pipe zone extends to one (1) foot above the top of pipe.
9. Rock Excavation: Solid rock material that cannot be excavated using conventional methods.
10. Select Material: Non-expansive soil material that is free from organic matter, debris and clumps, stones or clods larger than 3" as described in this Specification.
11. Springline: An imaginary line through the centerline of a pipe and horizontal to the ground. Also referred to as the haunch of the pipe.
12. Structural Fill: Soil materials approved by the Client's Representative and used to raise existing grades.
13. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill upon which base or subbase material or constructed works are placed.
14. Suitable Material: Soil material that meets the required specifications for its intended purpose as described in this Specification and on the Drawings.
15. Suitable Native Fill: Native Soil that has been excavated on-site, identified as meeting the requirements for use as a backfill material. It has had all organic material, rocks of unacceptable size, and any other deleterious material removed, and protected from contamination while being stockpiled on site.
16. Surplus Material: Excavated native material in excess of the project requirements. Surplus Material shall be placed on site in locations and to the grades and compaction requirements of the geotechnical engineer.
17. Topsoil: The nutrient rich upper layer of soil suitable for landscape plantings. Topsoil material may have organic content per Section 31 22 00 – Earthwork and Grading.
18. Unauthorized Excavation: Removal of material, whether suitable or unsuitable material, beyond the excavation limits of the design.
19. Undisturbed Native Soil: Natural soil material as it exists in situ without being turned, graded, scratched or in any way disturbed.
20. Unsuitable Material: Any material that does not meet the required specifications for its intended purpose.

1.03 REFERENCES

A. ASTM International

1. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
2. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity Flow Applications .
3. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
4. ASTM D3740 – Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
5. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
6. ASTM E329 – Standard Specification for Agencies Engaged in the Inspection, Testing, or Special Inspection.
7. ASTM C150 – Standard Specification for Portland Cement
8. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete

- 9. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- B. Caltrans Standard Specifications
 - 1. Section 19, Earthwork.
- C. CAL/OSHA, Title 8.
- D. Uniform Soil Classification System

1.03 SUBMITTALS

- A. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.
- B. Samples for Verification: For each type of material, provide 1-quart sample (in jar or heavy duty ziplock bag).
- C. Material Test Reports: For each soil material used as trench backfill, provide soil analysis by a qualified geotechnical engineer indicating suitability for intended use as described below.

1.04 QUALITY ASSURANCE

- A. Contractor shall keep logs of trenching and backfilling activity. Logs will include date, depth, material, means of compaction, moisture content, compaction achieved and any other relevant information to verify satisfactory completion of the Work in accordance with these Specifications.
- B. The log shall be signed off by the Supervisor of the Work each day that trenching and backfilling occurs.
- C. Testing Agency: The supplier's certification will be acceptable as verification that the soil material provided by that supplier meets the requirements specified above. In the event that the material properties are in dispute, the Contractor shall engage a qualified testing agency to evaluate soils properties. It is the Contractor's responsibility to provide materials that meet specification and to provide certified validation of the same. Verify testing procedures and certification programs with standards organizations. Verify type of label or stamp provided by standards organization.
- D. Any soil material will be considered defective if it does not pass tests and inspections.
- E. The Engineer shall retain the soil sample provided by the Contractor for comparison to soils delivered to the job site. Should delivered materials significantly differ in appearance in terms of gradation and/or soils properties, from the sample provided, the material will be rejected. The Contractor may have a new sample tested, at his own expense, to determine if it conforms to the specification. If it is determined to be unsuitable, it shall be immediately removed from the site at the Contractor's expense.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. All soils materials, stockpiled on site shall be protected from excessive moisture, including from rain or surface sources.
- B. All soils materials stockpiled on site shall be protected from erosion and discharge to drainage structures. Soils shall also be protected from wind erosion.
- C. Stockpiled materials of different types shall be maintained separately and not allowed to mix.

1.06 PROJECT CONDITIONS

- A. Weather and Ground Water
 - 1. The Contractor is responsible for completion of the Work in compliance with these Specifications, regardless of the weather or presence of groundwater.

2. The Contractor shall review the geotechnical report and any other available sources to understand the potential depth to groundwater.
 3. Water shall not be allowed to enter any open trench to the extent that impacts the integrity of the trench, bottom, bedding or backfill such that requisite compaction cannot be achieved.
- B. Safety
1. It is the Contractor's responsibility to employ adequate and appropriate shoring of trenches.
 2. It is the Contractor's responsibility to safeguard his employees and the public from hazards related to open trenches.
 3. Maximum allowable open trench is 600 linear feet at any one time. All trenches are to be covered at end of workday. All trench plates must have non-skid epoxy coating.
- C. Underground Utilities and Conflicts
1. The best available depiction of existing conditions was provided on the Drawings. No guarantee is made that underground utilities, appurtenances or other conflicting obstructions to the Work as shown on the Drawings is accurate or complete. The Contractor is advised to use the provided information with caution and to conduct his own investigation to confirm this information and/or identify any additional conflicts that may exist prior to commencement of the Work.
 2. Should the Contractor identify conflicts that had not been shown on the Drawings or are found to be in a different location than shown, now in conflict with the Work, the Contractor shall immediately notify the Engineer for direction prior to proceeding with the Work.
- D. Promptly notify the Engineer of surface or subsurface conditions differing from those disclosed in the Geotechnical Report. No claim for conditions differing from those anticipated in the Contract Documents and disclosed in the Geotechnical Report will be allowed unless Contractor has notified the Engineer in writing of differing conditions prior to contractor starting work on affected items.

PART 2 MATERIALS

2.01 SUITABLE SOIL MATERIALS

- A. All soil materials shall be subject to acceptance by the Geotechnical Engineer. Descriptions below may be overridden by the Geotechnical Engineer.
- B. Bedding Material
1. Bedding material shall be clean and free of organic material, debris, clay, cement or other contaminants.
 2. Bedding material for all plastic pipe and any type of pipe less than 6-inch in diameter shall be clean poorly graded coarse sand per Caltrans Standard Section 19-3.02F free of clay or organic material, meeting the following gradation requirements:

Coarse Sand	
Sieve size	% Passing
No. 4	90-100
No. 200	0-5

3. Bedding material for non-plastic pipe 6-inches or larger in diameter shall be $\frac{3}{4}$ " Class 2 Aggregate Base (per Caltrans Standard Section 26-1.02B). Material shall be crushed or

angular stone that can be compacted to a firm well-draining base. Material shall have a minimum R-value of 78. Material shall meet the following grading analysis:

Class 2 Ag Base	
Sieve size	¾" Max
	% Passing
2"	-
1-1/2"	-
1"	100
¾"	87-100
No. 4	30-65
No. 30	5-35
No. 200	0-12

C. Pipe Zone Backfill

1. Within the pipe zone, backfill material shall be clean, well-draining, poorly graded material free of clay, silt, organic material or debris.
2. Acceptable pipe zone backfill material includes the following:
 - a. Clean Coarse Sand as specified for pipe bedding for plastic pipe and pipes smaller than 6-inches in diameter.
 - b. 3/8-inch Pea Gravel: Clean, hard, semi-rounded stone, free from clay or organic material with the following gradation requirements:

3/8" Pea Gravel	
Sieve size	3/8"
	% Passing
1"	100
3/8"	95-100
No. 4	0-30
No. 200	0-2

D. Trench Zone Backfill

1. Acceptable Trench Zone Backfill shall consist of clean, non-expansive, compactable soil, being free of clay, organic matter, debris and any clods, stones or other matter larger than 3-inch diameter.

2. Trench Zone Backfill must meet the requirements of the Geotechnical Engineer, whether specified in the geotechnical report or any other means. No material rejected by the Geotechnical Engineer shall be incorporated into the trench.
 3. Trench zone backfill may be suitable native fill or imported fill, provided it meets the requirements of this Specification and is acceptable to the Geotechnical Engineer.
- E. Final Backfill
1. Unless otherwise indicated on the Drawings, the final (top) 12-inches of fill to finished grade is deemed to be the final backfill zone.
- F. Foundation Rock Fill
1. Foundation Rock Fill shall consist of Class 2 Crushed Rock Aggregate Base, per Caltrans Specifications.
 2. At the Contractor's discretion, either $\frac{3}{4}$ -inch Ag Base or 1 $\frac{1}{2}$ -inch Aggregate Base is acceptable.
- G. Controlled Density Fill (CDF)
1. CDF may be accepted in lieu of sand or granular fill as a nonstructural backfill only upon written approval from the Engineer. CDF shall not be used for structural backfill.
 2. Allowable components of CDF are:
 - a. Coarse aggregate in the form of $\frac{3}{8}$ -inch pea gravel as defined above under Pipe Zone Backfill;
 - b. Fine aggregate in the form of coarse sand as defined above under Bedding Material and shall not form more than 70% of total aggregate content;
 - c. Type II portland cement per ASTM C150
 - d. Fly ash per ASTM C618.
 - e. Air entrainment agent per ASTM C260.
 - f. Water shall be free of oils, particulates, chemicals or any other substance which result in any adverse effect on the quality of the backfill material.
 3. CDF components shall be proportioned such that at least 90 lbs. but not more than 180 lbs. (**80 kg**) of cement are used for each cubic yard of material produced.
 4. Water content shall be sufficient to produce a fluid, workable mix that will flow and can be pumped without segregation of the aggregate while being placed.
 5. Entrained air shall be a minimum of 8.0%.
 6. Material shall reach an unconfined compressive strength of at least 50 psi at 28 days.
 7. CDF materials shall be thoroughly machine mixed at a batch plant and delivered to the job site by means of transit mixing trucks. Material tags from the supplier shall be retained and made available to the Engineer upon request.
 8. CDF shall be placed in the Work within one hour after mixing.

2.02 UNSUITABLE MATERIALS

- A. Unsuitable materials include the following:
1. Any material rejected by the Geotechnical Engineer;
 2. Any material classified as CH, MH, OL or OH as defined by the Uniform Soil Classification System.
 3. Any material containing debris, organic matter, large clods, rubble or stones.
 4. Any expansive material or material containing clumps of clay.

2.03 UNDERGROUND PIPE MARKER AND IDENTIFICATION TAPE

- A. Provide tape on 3-inch minimum width rolls with "CAUTION, BURIED (intended service) LINE BELOW" or similar wording printed continuously over the entire tape length. Color and printing shall be permanent, unaffected by moisture or soil.

1. Warning Tape Color Codes.
Red: Electric.
Yellow: Gas, Oil; Dangerous Materials.
Orange: Telephone and Other Communications.
Blue: Water Systems.
Green: Sewer Systems.
White: Steam Systems.
Gray: Compressed Air.
2. Warning Tape for Metallic Piping:
 - a. Acid and alkali-resistant polyethylene plastic tape.
 - b. Minimum thickness of tape shall be 0.003 inch.
 - c. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.
3. Detectable Warning Tape for Non-Metallic Piping:
 - a. Polyethylene plastic tape.
 - b. Minimum thickness of the tape shall be 0.004 inch.
 - c. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise.
 - d. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3-feet deep.
 - e. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

PART 3 - EXECUTION

3.1 LINES AND GRADES

- A. Lay pipes to lines and grades indicated on Drawings.
- B. Engineer reserves right to make changes in lines, grades and depths of utilities when changes are required for Project conditions.
- C. Use laser-beam instrument with qualified operator to establish lines and grades.

3.2 PREPARATION

- A. Call the District not less than 3 working days before performing Work.
 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours and datum locations.
- C. Protect plant life, lawns and other features remaining as portion of final landscaping.
- D. Protect bench marks, sidewalks, paving and curbs from excavating equipment and vehicular traffic.
- E. Maintain and protect above and below grade utilities indicated to remain.

3.3 TRENCHING

- A. Excavate subsoil required for utilities to utility service.
- B. Remove lumped subsoil, boulders, and rock up of 1/6 cubic yard, measured by volume.
- C. Do not advance open trench more than 200 feet ahead of installed pipe.
- D. Cut trenches to width indicated on Drawings. Remove water or materials that interfere with Work.
- E. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe.
- F. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe materials.
- G. Do not interfere with 45 degree bearing splay of foundations.

- H. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls can not be sloped, provide sheeting and shoring to protect excavation as specified in this section.
- I. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Engineer until suitable material is encountered. Notify Engineer and request instructions.
- J. Cut out soft areas of subgrade not capable of compaction in place. Backfill and compact to density equal or greater than requirements for subsequent backfill material.
- K. Trim excavation. Remove loose matter.
- L. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.
- M. Remove excess subsoil not intended for reuse, from site.

3.4 BACKFILLING

- A. Backfill trenches to contours and elevations with unfrozen fill materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Place geotextile fabric prior to placing fill materials.
- D. Place fill material in continuous layers and compact.
- E. Employ placement method that does not disturb or damage foundation perimeter drainage and utilities in trench.
- F. Maintain optimum moisture content of fill materials to attain required compaction density.
- G. Do not leave more than 50 feet of trench open at end of working day.
- H. Protect open trench to prevent danger to the District and the Public.

3.5 FIELD QUALITY CONTROL

- A. Perform laboratory material tests in accordance with ASTM D1557, ASTM D698 or AASHTO T180.
- B. Perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D1556, ASTM D2167 or ASTM D2922
 - 2. Moisture Tests: ASTM D3017.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace, compact and retest.

3.6 PROTECTION OF FINISHED WORK

- A. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

SECTION 31 25 00 – EROSION AND SEDIMENTATION CONTROL

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. Additional information concerning earthwork may be found in the geotechnical investigation report; Geotechnical Design Geological Hazards Evaluation Report Horticultural Center Merritt College, August 7th, 2020 by Terraphase Engineering, available by request. All requirements of this report shall be followed unless noted otherwise.
- C. Stormwater Pollution Prevention Plan (SWPPP) prepared by the Contractor, refer to Section 00 73 13 – SPECIAL CONDITIONS.

1.2 SUMMARY

- A. Section Includes:
 - 1. Temporary erosion and sedimentation control measures.
- B. Related Sections
 - 1. Section 31 10 00 – Site Clearing
 - 2. Section 31 22 00 – Earthwork and Grading

1.3 REFERENCES

- A. ASTM: Standards of the American Society for Testing and materials apply where cited on this Section. Use applicable year of adoption or revision as published in the 2018 “Annual Book of ASTM Standards”
- B. Earthwork materials and methods of construction shall be in accordance with referenced sections of the latest revision of the Standards Specifications of the State of California Department of Transportation (Caltrans).

1.4 DEFINITIONS

- A. Topsoil: natural or cultivated surfaces-soil layer containing organic matter and sand, silt, and clay particles, friable, pervious, and black or a darker shaded of brown, gray, or red than underlying subsoil, reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch diameter., and free of subsoil and weeds, roots, sticks, construction debris, toxic materials, or other non-soil materials.

1.5 SITE CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks and other adjacent occupied or used facilities during site-clearing and earthwork operations.

1.6 SUBMITTALS

- A. Temporary Drainage Shop Drawing. Provide temporary drainage shop drawing to meet the storm requirements and adjustments warranted in response to construction staging and phasing.
- B. Submittals will be required for the following materials:
 - 1. Silt Fence
 - 2. Filter Screen
 - 3. Filter Fabric
 - 4. Hard Surface Guard

PART 2 - PRODUCTS

2.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL PRODUCTS

- A. Basis of design products: Use products specified on the Erosion Control Plan

2.2 TEMPORARY DRAINAGE

- A. Based on site conditions and phasing of work Contractor to develop temporary drainage strategies for conveyance and management of stormwater management to mitigate the 10 year storm per C.3 Stormwater regulations required by the County of Alameda.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the Erosion Control Plan, specific to the site that complies with California Water Quality Control Board requirements or authorities having jurisdiction, whichever is more stringent.
- B. Contractor shall refer to Stormwater Pollution Prevention Plan (SWPPP) for the Project.
- C. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established and Project is complete.
- D. Remove erosion and sedimentation controls and accumulated silt. Silt may be mixed with subsoil in softscape areas as an alternative to removing it from the site. Restore and stabilize areas disturbed during removal.

3.2 CLEARING AND GRUBBING

- A. Refer to Specification Section 31 10 00 – Site Clearing.

END OF SECTION

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SECTION 31 63 29 - DRILLED CONCRETE PIERS AND SHAFTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Dry-installed drilled piers at soldier pile retaining walls.

1.02 RELATED SECTIONS

A. Section 01 56 39 "Temporary Tree and Plant Protection"

1.03 UNIT PRICES

- A. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length, shaft diameter, and bell diameter if applicable, may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments are made on net variation of total quantities, based on design dimensions for shafts and bells.
1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft, and the diameter of shaft.
 2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing and inspecting, and other items for complete drilled-pier installation.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture.
- C. Shop Drawings: For concrete reinforcement.

1.05 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Material certificates.
- C. Material test reports.
- D. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Record drawings.

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1.07 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

1.08 FIELD CONDITIONS

A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for drilled piers.
2. The geotechnical report is referenced elsewhere in the Project Manual.

B. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.

1. Record and maintain information pertinent to each drilled pier and indicate on record Drawings.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Drilled-Pier Standard: ACI 336.1 except as modified in this Section.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

2.03 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C150/C150M, Type I/II.
 - a. Fly Ash: ASTM C618, Class F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.

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- B. Normal-Weight Aggregate: ASTM C33/C33M, graded, 3/4-inch nominal maximum coarse-aggregate size.
 - 1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C94/C94M and potable.
- D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 2. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 - 3. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
 - 4. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

2.04 CONCRETE MIXTURES AND MIXING

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 limits as if concrete were exposed to deicing chemicals.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Proportion normal-weight concrete mixture as follows:
 - 1. Compressive Strength (28 Days): 3000 psi.
- E. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered.
- B. Excavate shafts for drilled piers to indicated depths. Remove loose material from bottom of excavation.

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- C. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect.
 - 1. Do not excavate shafts deeper than elevations indicated unless approved by Architect.
 - 2. Payment for additional authorized excavation is according to Contract provisions for changes in the Work.
- D. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.
 - 1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete.
- E. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.
- F. All work to comply with tree protection requirements as described in Section 01 56 39 "Temporary Tree and Plant Protection".

3.02 INSTALLATION

- A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by a qualified Special Inspector.
- C. Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
- D. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing. Vibrate top 60 inches of concrete after withdrawal of temporary casing.

3.03 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Drilled piers.
 - 2. Excavation.
 - 3. Concrete.
- B. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.
 - 1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-

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pier lengths and bearing capacities are determined by testing and inspecting agency.
Final evaluations and approval of data are determined by Architect.

C. Concrete Tests and Inspections: ACI 301.

3.04 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

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SECTION 32 01 90 - LANDSCAPE MAINTENANCE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Maintain plants in manner that promotes health, growth, color and appearance, to quality levels specified; replace dead, dying, and damaged plants at no extra cost to Owner.
 - 1. It is Contractor's responsibility to determine type and quantity of organic soil amendments and fertilizer required, based on soil testing recommendations.
 - 2. Perform soil analysis to determine type and quantity of soil amendments; test enough soil samples to obtain a comprehensive analysis; submit reports.
- B. Maintain newly planted landscape plants, including turf, trees, shrubs, vines, ground cover, perennials and bulbs.
- C. For the duration of construction operations, maintain in healthy and thriving condition existing and established landscape plants, which may include turf, trees, shrubs, hedges, vines, ground cover, perennials, bulbs and naturalized wildflowers within the contract limit of work. Maintain adequate irrigation to plants outside of contract limit of work.
- D. For the duration of construction operations, maintain in good condition and prevent damage to existing deer fence.
- E. Operate permanent irrigation system.
- F. Clean up landscaped areas.
- G. Maintenance period for newly installed planting and irrigation: 120 days from date of Substantial Completion as approved or established by the District.

1.03 RELATED REQUIREMENTS

- A. Section 01 56 39 – Temporary Tree and Plant Protection.
- B. Section 12 93 00 – Site Furnishing.
- C. Section 32 15 41 – Aggregate Paving with Admixture.
- D. Section 32 84 00 – Irrigation.
- E. Section 32 91 13 – Soil Preparation.
- F. Section 32 92 00 – Turf and Grasses.
- G. Section 32 93 00 – Plants.

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- H. Section 32 96 00 – Transplanting, for plants transplanted within the site and project scope.
- I. Section 33 47 27 – Bioretention.

1.04 REFERENCE STANDARDS

- A. ANSI A300 Part 1 - American National Standard for Tree Care Operations -- Tree, Shrub and Other Woody Plant Maintenance -- Standard Practices 2017.
- B. ANSI Z133.1 - American National Standard For Arboricultural Operations - Pruning, Repairing, Maintaining, And Removing Trees, And Cutting Brush - Safety Requirements 2012.
- C. ASTM D4972 - Standard Test Method for pH of Soils 2018.
- D. ASTM D5883 - Standard Guide for Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes 2018.
- E. International Society of Arboriculture.
- F. "Arboriculture: Care of Trees, Shrubs and Vines in the Landscape" by Richard W. Harris, Prentice-Hall, Inc., 1983.

1.05 SUBMITTALS

- A. Submit complete maintenance plan for all planting and irrigation, showing:
 - 1. Schedule of maintenance operations and monthly status report, including list of equipment and materials proposed for the job.
 - 2. Watering schedule, including irrigation volume and frequency.
 - 3. Fertilizer type, quantity, and schedule of application.
 - a. Synthetic fertilizers are not permitted.
 - 4. Herbicide and Pesticide application plan. Obtain approval of Owner for each individual type of herbicide or pesticide.
 - a. The use of systemic pesticides is prohibited
 - 5. Organic soil amendment type, quantity, and schedule of application.
 - 6. Personnel assigned, including supervisor.
 - 7. Inspection procedures, diagnostics, and remedies.
- B. Soil Tests and Analysis: Refer to Section 32 91 13 "Soil Preparation."
- C. Licenses, permits and insurance required by State or Federal agencies pertaining to maintenance work.
- D. Product Data: Manufacturer's data sheets on each fertilizer, and other soil amendment or treatment material to be used, showing trade name, composition, mixing instructions, recommended application rate, storage and handling instructions, and application instructions.
- E. Certificates: Certification of composition of the following as delivered:
 - 1. Fertilizer.
 - 2. Mulch.

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3. Pesticides.
 4. Herbicides.
 5. Other chemical materials.
- F. Installer Qualifications: As specified in paragraph 1.06.
- G. Site Reports: Include date, time, personnel, condition of plants, activities, temperature, precipitation, irrigation applied; record:
1. Each visit for maintenance purposes.
 2. Volume of water applied and area applied to.
 3. Diagnosis for treatment of unhealthy plants.
 4. Pesticide application; provide all additional reports and recordkeeping required by law.
 5. Herbicide application; provide all additional reports and recordkeeping required by law.
 6. Removal of dead plants, with quantity and diagnosis.
 7. Replanting.
 8. Volume of bio-degradable debris composted.
 9. Volume of wood chips produced.
 10. Volume of debris removed from site.
- H. Project Close-Out Submittal: Include in a single, 3-ring binder a landscape maintenance manual containing an indexed collection of all schedules, records and permits listed above, as well as documentation of accepted condition of planting and irrigation at Final Acceptance.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications:
1. Maintenance Contractor: The contractual entity that performed the planting installation.
 - a. The landscape contractor or maintenance subcontractor shall have a full-time employee assigned to the job as a foreman for the duration of the contract. He/she shall have a minimum of four (4) years experience in landscape maintenance supervision, with experience of training in entomology, pest control, soils, fertilizers and plant identification.
 - b. The foreman shall directly supervise the work force at all times. Notify Owner or changes in supervision.
 - c. The landscape maintenance labor force shall be thoroughly familiar with, and trained in, the work to be accomplished and shall perform the task in a competent, efficient manner acceptable to Owner.
 2. Pruners: Certified member, or supervised by certified member, of International Society of Arboriculture.
 3. Pesticide Applicators: Certified by authorities having jurisdiction.
 4. Herbicide Applicators: Certified by authorities having jurisdiction.
 5. Identification: Provide proper identification at all times for landscape maintenance firm's vehicles and labor force. Be uniformly dressed in a manner satisfactory to Owner.
- B. Arborist Certification: ISA certification for an independent arborist.
1. Arborist scope of services and contractual responsibilities to be approved by Peralta District.

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2. Arborist to submit all communication to the Construction Manager.

1.07 PROJECT/SITE CONDITIONS

- A. Site Visit: At beginning of maintenance period, visit and walk the site with the Owner's representative to clarify scope of work and understand existing project/site conditions.
- B. Documentation of conditions: Document general condition of existing trees, shrubs, vines, ground covers and other plants, recording all plants which are healthy, thriving, damaged, dead or dying.
- C. Irrigation System: Document general conditions of existing irrigation system, making sure that faulty electrical controllers, broken or inoperable sprinkler heads or emitters are noted.

1.08 SEQUENCING AND SCHEDULING

- A. Perform all maintenance during hours mutually agreed upon between Owner and Contractor.
- B. Work force shall be present at the project site at least once a week and as often as necessary to perform specified maintenance in accordance with the approved maintenance plan.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver U.S. EPA-controlled materials to site in original containers with legible labels indicating registration number and registered uses.
- B. Deliver fertilizer and manufactured soil amendments to site in original containers bearing manufacturer's chemical analysis, name, trade name or trademark, and indication of compliance with applicable state and federal laws and regulations ; alternatively, bulk delivery with equivalent certificate is acceptable.
- C. Store fertilizer, soil amendments, and mulch in dry locations away from contaminants.
- D. Do not store pesticides, herbicides, or other chemical treatment materials in locations where they could damage seeds or plants.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Contract to submit cut sheets of recommended products suitable for project needs, location, and compliant with local use requirements.

2.02 MATERIALS

- A. Fertilizers: Free flowing granular organic type containing nitrogen, phosphorus, and potassium, plus trace minerals and micro-nutrients; controlled release type is preferred. Use approved organic compost whenever possible.
 1. Determine type and quantity based on soil analysis.

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2. Synthetic fertilizers are prohibited. All fertilizers have to be OMRI approved.
- B. Soil Amendments: Type and quantity as required to achieve specified results, based on soil analysis and recommendations.
- C. Herbicides, Insecticides and Fungicides:
 1. Best quality materials with original manufacturers' containers, properly labeled with guaranteed analysis.
 2. Use non-staining materials.
 3. Materials prohibited in the Generic Materials List by the Organic Materials Review Institute (OMRI) are prohibited on the project.
 4. Systemic pesticides and insecticides are prohibited on the project.
- D. Replacement Ties: Match originally accepted existing materials on the site.

2.03 APPLIED MATERIALS

- A. Organic Mulch: Maintain general appearance of existing mulched areas. Refer to Section 32 93 00 – Plants for types of acceptable mulch.
- B. Water: Potable; Owner's water supply may be used.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Review soil test report obtained by Contractor prior to planting operations and approved by Landscape Architect. Refer to Section 32 91 13 "Soil Preparation."

3.02 LANDSCAPE MAINTENANCE - GENERAL

- A. Obtain and follow the maintenance instructions provided by the installer of new plant materials.
- B. Protect existing vegetation, pavements, and facilities from damage due to maintenance activities; restore damaged items to original condition or replace, at no extra cost to Owner.
- C. General Cleanup: Remove debris from all landscape areas at least once a week and from turf areas before each mowing.
 1. Debris consists of trash, rubbish, dropped leaves, downed branches and limbs of all sizes, dead vegetation, rocks, and other material not belonging in landscaped areas.
 2. Remove debris from site and dispose of properly.
- D. Watering, Soil Erosion, and Sedimentation Control: Comply with federal, state, local, and other regulations in force; prevent over-watering, run-off, erosion, puddling, and ponding.
 1. Site grading and planting have been designed to resist erosion once fully grown, with temporary measures in place during establishment period.
 2. Repair temporary erosion control mechanisms provided by others.
 3. Repair eroded areas and replant, when caused by inadequate maintenance.

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4. Prevent sediment from entering storm drains.
- E. Trees: Exercise care to avoid girdling trees; provide protective collars if necessary; remove protective collars at end of maintenance period.
- F. Fertilizing: Apply fertilizer only when necessary.
- G. Earth Mound Watering Basins: Maintain in good condition and as required to permit efficient application of water without waste; reapply mulch if soil surface shows.
- H. Drainage Channels: Remove obstructions in gutters, catch basins, storm drain inlets, yard drains, swales, ditches, and overflows.
 1. Remove grates from catch basins to clean.
 2. Prevent encroachment of other vegetation on turf and surface drainage channels.
- I. Health Maintenance: Inspect all plants regularly for health:
 1. Eradicate diseases and damaging pests, regardless of severity or speed of effect.
 2. Treat accidental injuries and abrasions.
 3. If a plant is unhealthy but not yet dead, according to specified definitions, determine reason(s) and take remedial action immediately.
 4. Remove dead plants immediately upon determining that they are dead. Replace with in kind species and size within one week.
- J. Pesticide and Herbicide Application: Comply with manufacturer's instructions and recommendations and applicable regulations.
 1. Obtain Owner's approval prior to each application.
 2. Apply in manner to prevent injury to personnel and damage to property due to either direct spray or drifting, both on and off Owner's property.
 3. Use hose bibs for mixing with water; prevent spills.
 4. Inspect equipment daily before application; repair leaks, clogs, wear, and damage.
 5. Do not dispose of excess mixed material, unmixed material, containers, residue, rinse water, or contaminated articles on site; dispose off site in legal manner.
 6. Rinse water may be used as mix water for next batch of same formulation.
 7. Contractor is responsible for all recordkeeping, submissions, and reports required by laws and regulations.
- K. Weed control:
 1. All areas between plants, including watering basins, shall be weed free at all times.
 2. Use hand weeding as primary weed control method. Use only recommended and legally approved herbicides to control weed growth if hand weeding proves ineffective.
 3. Avoid frequent soil cultivation that destroys shallow roots and soil biology.
- L. Replanting: Perform replacement and replanting immediately upon removal of dead or injured plant. Replacement plants shall match species, variety, size, condition, and quantity of plants replaced. Replacements to be planted within one week of removal of dead plants.
- M. Pruning:
 1. Use only clean, sharp tools, adequate for the job.

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2. Take extreme care to avoid transmitting disease from one infected plant to another. Properly sterilize pruning tools before going from one infected plant to all other plants.
3. Prune trees to develop permanent scaffold branches that are smaller in diameter than the trunk or branch to which they are attached, and which have vertical spacing of 18 in. to 48 in. and radial orientation so as not to overlay one another.
4. Prune trees to eliminate diseased or damaged growth, and narrow V-shaped branch forks that lack strength, and co-dominant leaders in standard form trees. Reduce toppling and wind damage by thinning out crowns.
5. Prune trees to maintain growth within space limitations, maintaining a natural appearance and balancing crown with roots.
6. No stripping of lower branches ("raising up") of young trees is permitted.
7. Retain lower branches in a "tipped back" or pinched condition to promote caliper trunk growth (tapered trunk). Do not cut back to fewer than six buds or leaves on such branches. Only cut lower branches flush with the trunk after the tree is able to stand erect without staking or other support.
8. Thin out and shape evergreen trees when necessary to prevent wind and storm damage. Do primary pruning of deciduous trees during the dormant season. Do not permit any pruning of trees prone to excessive "bleeding" during growth season.
9. Prune damaged trees or those that constitute health or safety hazards at any time of year as required.
10. Make all cuts clean and close to the trunk, without cutting into the branch collar. "Stubbing" will not be permitted. Cut smaller branches flush with trunk or lateral branch. Make larger cuts (1 in. in diameter or larger) parallel to shoulder rings, with the top edge of the cut at the trunk or lateral branch.
11. Branches too heavy to handle shall be precut in three stages to prevent splitting or peeling of bark. Make the first two cuts 18 in. or more from the trunk to remove the branch. Make the third cut at the trunk to remove the resulting stub.
12. Do not prune or clip shrubs into balled or boxed forms.

3.03 IRRIGATION

A. General:

1. Repair without additional charge to Owner all damages to system caused by Contractor's operations. Perform all repairs within one (1) watering period.
2. Report promptly to Owner all accidental damage not resulting from Contractor's negligence or operations.
3. Do not run the irrigation system during rainy season. Set and program automatic controllers for seasonal water requirements.
4. Twice a month, use a probe or other acceptable tool to check the rootball moisture of representative plants as well as the surrounding soil.
5. Do not allow plants to wilt; apply water as required to supplement rainfall; do not waste water; do not water plants or areas not needing water; do not water during rainfall; shut off water flow when finished; repair leaks.
 - a. New automatic irrigation system may be used.
 - b. Owner's water source may be used.

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6. Adjust irrigation heads, sprinklers and emitters to water planted areas only. Prevent spraying on windows, building walls or paving by balancing the throttle control on the remote control valves and the adjustment screws on the sprinkler heads. Do not allow water to atomize and drift.
- B. Automatic Irrigation System: Obtain and follow manufacturer's operating and maintenance instructions.
1. Adjust sprinkler heads, drippers, valves, pumps, and controllers as required for optimum operation.
 2. During system warranty period, notify Landscape Architect and system installer promptly of defects and leaks that adversely affect irrigation performance.
 3. After end of system warranty period, service and repair all defects and leaks.
- C. Cleaning and Monitoring the System:
1. Continually monitor the irrigation systems to verify that they are functioning properly as designed. Make program adjustments required by changing field conditions.
 2. Clean pump filter and strainer at least once a year and as often as necessary to keep the irrigation systems free of sand and other debris.

3.04 TURF MAINTENANCE

- A. Maintain turf in manner required to produce turf that is healthy, uniform in color and leaf texture, and free from weeds and other undesirable growth.
1. Grass Density - Lawns: 20 plants per square foot, minimum.
 2. Bare Spots - Lawns: 2 percent of total area, maximum; 9 inches square, maximum.
 3. Keep turf relatively free of thatch, woody plant roots, diseases, nematodes, soil-borne insects, stones larger than 1 inch diameter, other materials detrimental to grass growth.
 4. Limit broadleaf weeds and foreign grass to a maximum of 2 percent of total area.
- B. Mowing: During growing season mow turf to uniform height, in manner that prevents scalping, rutting, bruising, and uneven or rough cutting.
1. Prior to mowing clean all debris and leaves from turf surface.
 2. Schedule frequency of mowing so that no more than one-quarter to one-third of grass leaf length is removed during a cutting.
 3. Make each successive mowing at approximately 45 degrees to the previous mowing, if practical.
 4. Cool Season Grasses:
 - a. Reduce mowing height in fall and spring.
 - b. Use rotary type mowers; mulcher type mowers may be used.
 5. Warm Season Grasses:
 - a. Increase mowing height slightly as fall approaches.
 - b. Use reel type mowers; do not use mulcher mowers.
- C. Summer Mowing Height for Lawns:
1. Bluegrass: 3 inches.
- D. Mowing Naturalized Grass Areas:

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1. Mowing Height: 6 inches.
 2. Mowing Frequency: One a season.
- E. Trimming: Immediately after each mowing, neatly trim perimeter of each turf area and around obstructions within turf area; match height and appearance of adjacent turf.
1. Adjacent to Pavements: Cut edges of turf to form a distinct, uniform turf edge.
 2. Adjacent to Planting Beds and Permanently Mulched Areas: Cut edges of turf to form a distinct, uniform turf edge.
 3. Around Trees and Poles: Where no planting bed or mulched area exists, trimming with string trimmer is acceptable.
 4. Irrigation Heads and Valve Boxes: Trim neatly so grass doesn't interfere with operation.
- F. Fertilizer: Apply as recommended by manufacturer and at rate indicated by soil analysis.
1. Cool Season Grasses: Apply at least once, in Fall before first frost; do not apply high nitrogen fertilizer during Summer; Spring application is optional but must be reduced in quantity.

3.05 PLANTING BED MAINTENANCE

- A. Planting beds include all planted areas except turf.
- B. Begin maintenance immediately after plants have been installed; inspect at least once a week and perform needed maintenance promptly.
- C. Keep planting beds free of pests; remove weeds by hand before reaching 1 inch height.
- D. Do not allow climbing, twining, or creeping plants to encroach into other species unless otherwise noted on Drawings.
- E. Ground Cover and Vines:
 1. Trim to encourage dense, well-developed growth covering intended areas.
 2. Do not allow plants to grow up trees, shrubs, or vines or encroach into turf or drainage channels, unless the drainage channel is intended to be planted with ground cover.
 3. Within contract limit scope of work, remove existing plants grown up trees.
- F. Flowering Plants: Remove dead flower heads; do not trim off leaves of flowering bulbs until they are brown.
- G. Replace mulch as required and remove debris. Refer to Section 32 93 00 "Plants" for types of acceptable mulch.

3.06 TREE AND SHRUB MAINTENANCE

- A. Trees will be considered dead when main leader has died back or when 25 percent or more of crown has died.
- B. Shrubs will be considered dead when 25 percent or more of plant has died.
- C. Inspect woody plants for health by scraping up to 1/16 inch square area of bark; no green cambium layer below bark shall be evidence of death.

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- D. Adjust stakes and ties as required to promote growth and avoid girdling.
- E. Pruning: Unless otherwise indicated, prune only to maintain balanced natural shape; follow recommendations of ANSI A300 and ANSI Z133.1 and best local practices for species involved.
- F. Shrubs: Prune at best time to influence ultimate shape and size for the particular species.
 - 1. Prune to balance the plant's form and according to its natural growth characteristics.
 - 2. Remove water shoots, suckers, and branches not meeting desired shape and size.
- G. Young Trees: Prune at best time to influence ultimate shape and size for the particular species; do not remove or cut off leader.
- H. Rejuvenation of Established Trees and Shrubs: Prune and trim as required to improve shape and balance as appropriate to the particular species; remove dead, damaged, and diseased branches and limbs; do not remove excess growth except as follows:
 - 1. Remove growth in front of windows, above or obstructing entranceways and walkways, leaning against structures, and obstructing vision.
 - 2. Per instruction of Landscape Architect, remove excess growth by pruning technique best suited to future growth for the particular species.
 - 3. Remove dead, damaged, and diseased branches and limbs and structurally weak limbs that may be a safety hazard.
 - 4. Remove low-hanging branches over vehicular traffic routes to height necessary to clear expected traffic including buses and moving vans.

3.07 CLEANING

- A. Remove fallen deciduous leaves in Fall; removal may wait until all leaves have fallen.
- B. Clean adjacent pavements of plant and other debris generated by maintenance activities.
- C. Remove and dispose of general cleanup debris and biodegradable debris in a proper manner; Owner's trash collection facilities may be used.
- D. Remove and dispose of general cleanup debris and biodegradable debris in a proper manner.
 - 1. Biodegradable Debris: Owner will designate a compost pile on site where biodegradable debris may be deposited; branches and bark are not considered biodegradable.
 - 2. Branches and Bark: Owner will designate a wood chip storage area; machine-chip all branch and bark debris.
 - 3. Non-Biodegradable Debris: Owner's trash collection facilities may be used.

3.08 TERMINATION OF THE MAINTENANCE PERIOD

- A. Final Acceptance Procedure:
 - 1. Work will be accepted by the Landscape Architect upon satisfactory completion of all work, including maintenance period, but exclusive of replacement of materials under the Warranty Period.

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2. Submit a written request to Landscape Architect for review for Final Acceptance at least five (5) working days prior to anticipated Final Review date, which is at the end of the Maintenance Period.
- B. Corrective Work:
1. Work requiring corrective action or replacement shall be performed within ten (10) calendar days after the Final Review.
 2. Perform corrective work and materials replacement in accordance with the Drawings and Specifications, and at no additional cost to the Owner.
 3. After corrective work is completed, the Contractor shall again request a Final Review for Final Acceptance as outlined above.
 4. Continue maintenance of all landscaped areas until such time as all corrective measures have been completed and accepted.
- C. Conditions for Acceptance of Work at End of Maintenance Period:
1. Each plant shall be alive and thriving, showing signs of growth and no signs of stress, disease, or any other weaknesses.
 2. Replace all plants not meeting these conditions. An additional Warranty Period equal in length to the original shall be commenced for all such plants and planted areas.
- D. Final Acceptance Date: The date on which the Landscape Architect issues a Letter of Final Acceptance. Upon Final Acceptance, the Owner will assume responsibility for maintenance of the work.

3.09 CLOSEOUT

- A. Maintenance Record: Submit binder to Owner with all documentation and records required and utilized during the maintenance period.
- B. Keys and Identification: Return all keys and identification materials supplied by Owner for the purpose of site access.
- C. Remove and properly dispose of the following items from site:
1. Temporary tree protection fencing and signage, temporary root protection. Refer to Section 01 56 39 "Temporary Tree and Plant Protection."
 2. Contractor's temporary watering devices.
 - a. Owner-provided temporary watering devices to remain on site, in locations designated by Owner's Representative.
- D. Verify with Owner whether it is acceptable to leave stockpiled excess mulch and soil on site.

END OF SECTION

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SECTION 32 12 16 – ASPHALT PAVING

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. Additional information concerning earthwork may be found in the geotechnical investigation report; Geotechnical Design Geological Hazards Evaluation Report Horticultural Center Merritt College, August 07, 2020 by Terraphase Engineering, available by request. All requirements of this report shall be followed unless noted otherwise.

1.2 SUMMARY

- A. Section Includes:
 - 1. Hot-mix asphalt paving and patching within public right of way.
 - 2. Pavement markings on vehicular pavement surfaces.
- B. Related Sections:
 - 1. Section 32 13 13 – CONCRETE PAVING
 - 2. Section 31 22 00 – EARTHWORK AND GRADING

1.3 REFERENCES

- A. Peralta Community College District Standards and Specifications
- B. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where cited in this Section. Use applicable year of adoption or revision as published in the 2009 "Annual Book of ASTM Standards".
- C. Earthwork materials and methods of construction shall be in accordance with referenced sections of the latest revision of the Standard Specifications of the State of California Department of Transportation (Caltrans), 2018 edition.

1.4 DEFINITIONS

- A. Hot-mix asphalt paving terminology: Refer to ASTM D 8 for definitions of terms.
- B. Paint Binder: Pavement tackifier or binder.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by Caltrans.

- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Caltrans Standard Specifications requirements for asphalt paving work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure.
- B. Do not install pavement markings until the finished pavement surface has fully cured or set in accordance with the manufacturer's recommendations, or if environmental conditions do not meet the manufacturer's installation requirements.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations. Aggregates shall conform to Caltrans Standard Specifications and the Geotechnical Report.
- B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Aggregate Base:
 - 1. Aggregate base shall be Class 2 aggregate base and conform to Caltrans Standard Specifications Section 26. The aggregate base shall be placed to the depth as shown on the Plans and as recommended by the Geotechnical Engineer, and compacted to 95% compaction per ASTM D1557. Aggregate base materials shall consist of virgin rock aggregate only unless clarification can be provided that any proposed recycled materials are free of hazardous and/or deleterious contaminants.
- D. Warranty:
 - 1. Contractor shall repair or restore to first class conditions any portion of the asphaltic paving in which weed growth, creeping, showing, revealing, cracking, softening, excessive or uneven settlement due to improper placing, or defective materials that appear or become apparent within one (1) year from date of acceptance.

2.2 ASPHALT MATERIALS

- A. Asphalt Cement: Type A, with ½ inch maximum, medium graded aggregate and AR-4000 or approved equal.

- B. Paving asphalt to be mixed with aggregate shall be steam extra space refined asphalt conforming to the provision of Caltrans Standard Specifications.
- C. Tack Coat: ASTM D 977 emulsified asphalt, or ASTM D 2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- D. Water: Potable
- E. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 AUXILIARY MATERIALS

- A. Sand: AASHTO M 29, Grade Nos. 2 or 3.
- B. Joint Sealant: Per Caltrans Standard.
- C. Paving Geotextile (if required by Geotechnical Engineer): Mirafi 500X or approved equivalent.
- D. Paint Binder for pavement mar

2.4 MIXES

- A. Hot-Mix Asphalt: In conformance to requirements in accordance with the Caltrans Standard Specifications.
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Provide mixes complying with composition, grading, and tolerance requirements in ASTM D 3515 for the following nominal, maximum aggregate sizes:
 - a. Base Course: 2-inch Asphaltic Concrete.
 - b. Surface Course: 1 ½ inch Asphaltic Concrete

2.5 PAINT BINDER

- A. General: Paint binder shall be applied to all surfaces on or against which an asphalt concrete course is to be laid, except a preceding asphaltic course of the same pavement laid within the preceding asphaltic course of the same pavement laid within the preceding 24 hours, or except temporary pavement.
- B. Paint binder shall be emulsified asphalt Type SS-1 in accordance with the Asphalt Institute Specifications.
- C. Before application, contractor shall remove all loose particles, sand, dust and other foreign materials by power brooming with an approved street sweeping machine.
- D. Large cracks, spalls and chuckholes, particularly reflective cracks occurring in the existing asphaltic surface over the joints of concrete roadway base shall be thoroughly cleaned and repaired with asphalt slurry mixture or other asphaltic materials as directed by the District. The repair shall be done at least 24 hours before paving, unless otherwise directed by the District.

2.6 PAINT BINDER FOR PAVEMENT MARKINGS

- A. Water based, latex type, pigment coating must comply with MPI approved product lists for MPI #97. Coating color to match existing condition unless otherwise noted per plan.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
 - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the City inspector, and replace with compacted backfill or fill as directed.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Contractor, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.
- D. Notify the Owner's Representative in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Geotechnical Engineer and the Inspector of Record (IOR).

3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
 - 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Paint Binder: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.10 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 PATCHING FOR PAVEMENT MARKINGS

- A. Paint Binder: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.10 gal./sq. yd. (Shall be applied by spraying)
 - 1. Do not install/apply during cold or rainy weather.
 - 2. Allow paint binder to cure undisturbed before applying hot-mix asphalt paving.
 - 3. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
 - 4. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.6 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread mix at minimum temperature of 250 deg F.
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
 - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 PAVEMENT MARKING ON ASPHALT

- A. Surface preparation
 - 1. Use mechanical wire brush to remove dirt, contaminants, and loose material from the pavement surface that is to receive the traffic stripe or pavement marking.
 - 2. Use abrasive blast cleaning to remove laitance and curing.
- B. Application of stripes and markings
 - 1. Apply MPI #97 approved latex pavement marking with stencil or a preformed marking.
 - 2. Apply paint for a pavement marking with a stencil and hand spray equipment or rolling per plan and/or to match existing conditions.
 - 3. Immediately remove drips, overspray, improper marking and paint tracked by traffic using authorized methods.
 - 4. Apply a traffic stripe or a pavement marking to a dry surface during a period of favorable weather when pavement surface is above 50 degrees Fahrenheit.

3.9 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.
- C. Pavement Surface Gradients:
 - 1. Pavement gradients shall not exceed accessibility code requirements for maximum longitudinal and cross-slopes per the Plan.
 - 2. Pavement gradients shall not be less 1%.
 - 3. Contractor shall notify The District if minimum and/or maximum slopes cannot be achieved as indicated on the Plans prior to proceeding further with pavement installation.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor shall engage a qualified testing agency to perform tests and inspections as required.

3.11 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
- B. Reference Section 01 74 19 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

END OF SECTION

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SECTION 32 13 13 – CONCRETE PAVING

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. Additional information concerning earthwork may be found in the geotechnical investigation report; Geotechnical Design Geological Hazards Evaluation Report Horticultural Center Merritt College, August 07, 2020 by Terraphase Engineering, available by request. All requirements of this report shall be followed unless noted otherwise.
- C. Stormwater Pollution Prevention Plan (SWPPP), refer to Section 00 73 13 – SPECIAL CONDITIONS.
- D. This Section includes exterior cement concrete pavement for the following:
 - 1. Vehicular-loaded concrete paving
 - 2. Curbs, Curb and Gutter
 - 3. Utility Concrete Pads
 - 4. Concrete sidewalk and walkways.
- E. This section does not cover concrete foundation within property, or concrete paving within public right of way.
- F. Related Sections:
 - 1. Section 02 41 13 – SITE DEMOLITION
 - 2. Section 31 22 00 – EARTHWORK AND GRADING
 - 3. Section 07 92 00 – PAVEMENT JOINT SEALANTS

1.2 REFERENCES

- A. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where cited in this Section. Use applicable year of adoption or revision as published in the 2018 "Annual Book of ASTM Standards".
- B. Concrete pavement materials and methods of construction shall be in accordance with referenced sections of the latest revision of the Standard Specifications of the State of California Department of Transportation (Caltrans), 2018 edition.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

- A. Mix design for each class of concrete included in this specification.
- B. Laboratory test reports for concrete mixes.

- C. Compression test data (field experience method) or results of testing (trial batch method) used to establish mix proportions.
- D. Product Data: Provide data on admixtures, curing materials, vapor retarder, joint devices, and permanent concrete accessories.
- E. Submit ticket to the District's Testing Laboratory for each batch of concrete delivered to the job site, bearing the following information. Refer to FIELD QUALITY CONTROL Article of this Section.
 - 1. Mix Identification
 - 2. Weight of cement, aggregate, admixtures, water added at the batch plant, water added at site (only when allowed by inspector)
 - 3. Aggregate size.

1.5 QUALITY ASSURANCE

- A. Standards: Comply with provisions of the following specifications and standards, except where more stringent requirements are shown or specified:
 - 1. ACI 301 - "Specifications for Structural Concrete for Buildings."
 - 2. ACI 318 - "Building Code Requirements for Reinforced Concrete."
- B. Contractors Design Laboratory: When mixes are proportioned by trial batch method, engage a laboratory conforming to ASTM E329 and under direction of a Civil Engineer licenses in the state of California.
 - 1. Conform to ACI 305R and CBC Section 1905.13 when concreting during hot weather.
 - 2. Conform to ACI 306R and CBC Section 1905.12 when concreting during cold weather.
 - 3. Batch plant shall be inspected per CBC.

1.6 COORDINATION

- A. Coordinate the placement of joint devices, steel embedment, anchor bolts, utility penetrations, and other elements that are to be integral with concrete with erection of concrete formwork and placement of form accessories.
- B. Coordinate the addition of admixture to concrete mixing trucks at the job site with the District's Inspection & Testing laboratory, when applicable.

1.7 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

- A. Timber forms shall be used for straight alignments, shall be surfaced on the side next to the concrete, shall have a true, smooth upper edge, and shall not be less than 1-1/2 inches thick after being surfaced.
- B. Flexible or curved forms shall be used for curves with radius 100 feet or less.

2.2 STEEL REINFORCEMENT

- A. Onsite concrete curbs, headers and gutters: Use ½-inch diameter deformed bars unless otherwise noted on the Plans. Reinforcing steel shall conform to the requirements for bar steel as set forth in Section 52 of the Caltrans Standard Specifications.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
 - 1. Portland Cement: ASTM C 150, Type II
- B. Aggregates:
 - 1. Normal-Weight Aggregates: ASTM C 33, coarse aggregate, uniformly graded.
 - 2. Provide aggregates from a single source.
 - 3. Maximum Coarse-Aggregate Size: 1 inch nominal.
 - 4. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: Potable.

2.4 RELATED MATERIALS

- A. Pre-molded-Joint-Filler: ASTM D1751, non-extruding and bituminous type resilient filler.

2.5 CONCRETE MIXES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 3,500 psi.
 - 2. Slump Limit: 4 inches, plus or minus 1 inch.
 - 3. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 4-percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture, water-reducing and retarding admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

- B. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons.
 - 3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Section 31 20 00 – Earth Moving.
- C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.
- B. Subgrade preparation and compaction shall be performed under the observation of the Geotechnical Engineer.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Extend wood forms for all exposed concrete at least 6 inches below finish grade.
- C. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 FINISHES

- A. For paving within in project property, refer to Landscape Plans for all paving finishes.

3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

3.6 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 2. Provide tie bars at sides of paving strips where indicated.
 3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation/Expansion Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
1. Locate expansion joints at changes in materials and at edges of slab.
 2. Extend joint fillers full width and depth of joint.
 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 4. Place top of joint filler flush with finished concrete surface.
 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Control / Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. 1/4 the thickness of the concrete in depth.
 2. 1/8-inch maximum width.
 3. Spaced at a maximum of 15 feet apart.
 4. Perform all cuts cleanly and smoothly to a constant and equal depth in as continuous an operation as possible to avoid misalignment of joints. Use only experienced personnel and forms or templates as required to achieve consistent lines.
 5. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

- 6. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.7 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- C. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- D. Do not add water to concrete during delivery or at Project site.
- E. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
- H. Screed pavement surfaces with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

3.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

3.9 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117-81.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: The District will select a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- C. Test results shall be reported in writing to the District, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- D. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- E. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

3.11 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

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SECTION 32 14 00 - UNIT PAVING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 RELATED SECTIONS

- A. Section 03 30 00 – Cast-In-Place Concrete, for unit paving edging, curbs, stairs, and footings.
- B. Section 04 22 00 – Concrete Unit Masonry, for adjacent raised planters and structures.
- C. Section 31 22 00 – Earthwork and Grading
- D. Section 32 12 16 – Asphalt Paving, for adjacent paving.
- E. Section 32 13 13 – Concrete Paving, for adjacent paving.
- F. Section 32 14 43 – Porous Unit Paving, for GrassCrete and Core Gravel paving.
- G. Section 32 15 41 – Aggregate Paving with Admixture, for adjacent paving.
- H. Section 32 17 26 – Tactile Warning Surfaces, for truncated dome pavers.
- I. Section 32 84 00 – Irrigation, for sleeving.
- J. Section 32 93 00 – Plants, for wood header.

1.03 SUMMARY

- A. Section Includes: Precast concrete pavers, pedestrian and vehicular grade.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.05 ACTION SUBMITTALS

- A. Product Data:
 - 1. All types of pavers
 - 2. Mortar
 - 3. Setting sand and gravel
 - 4. Permeable paver fill material
- B. Paver edging
- C. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C 136.
- D. Samples for Initial Selection:

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1. For each type of unit paver indicated, include color and finish.
2. For each type of mortar, include color.

E. Samples for Verification:

1. For full-size units of each type of unit paver indicated, include color, finish and size.
2. For each type of mortar, include color.
3. Fill material, one quart volume in a sealed plastic bag. Label product type and source.

1.06 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements and standards. Provide for each type and size of unit.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with requirements.

1.07 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
- B. Mockups to be 3 feet by 3 feet minimum and demonstrate desired paving pattern including color variation, joints and edging for the following:
 1. Unit pavers set in mortar.
 2. Unit pavers set in sand.
 3. Subgrade concrete edging.
 4. Wood header edging.
- C. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 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 cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.09 FIELD CONDITIONS

- A. Cold-Weather Requirements: Comply with cold-weather construction requirements per TMS 602/ACI 530.1/ASCE 6. Remove and replace unit paver work damaged by frost.

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- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.
 - 1. When ambient temperature exceeds 100 deg F, or wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set pavers within 1 minute of spreading mortar bed.

PART 2 PRODUCTS

2.01 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.

2.02 PAVERS

- A. Concrete unit pavers:
 - 1. Pedestrian grade: Refer to Landscape Drawings.
 - 2. Truncated dome pavers: Refer to Landscape Drawings.
 - a. Refer to Section 32 17 26 "Tactile Warning Surfaces"
 - 3. Vehicular grade: Refer to Landscape Drawings.

2.03 EDGING

- A. Refer to Drawings for types and locations of unit paver edging.
- B. Refer to Section 03 30 00 "Cast-In-Place Concrete" for subgrade concrete edging.
- C. Refer to Section 32 93 00 "Plants" for wood header.

2.04 AGGREGATE SETTING-BED MATERIALS

- A. Graded Aggregate for Base: Sound, crushed stone or gravel complying with ASTM D 448 for Size No. 8, ASTM D 2940/D 2940M, base material.
- B. 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.
- C. Provide sand of color needed to produce required joint color.
- D. 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:
- E. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
- F. Permittivity: 0.5 per second, minimum; ASTM D 4491.
- G. UV Stability: 50 percent after 500 hours' exposure, ASTM D 4355.

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2.05 MORTAR SETTING-BED MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type II.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Sand: ASTM C144.
- D. Water: Potable

2.06 MORTAR MIXES

- A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimal performance characteristics. Discard mortars if they have reached their initial set before being used.
- B. Mortar-Bed Bond Coat: Mix cement and water to a creamy consistency.
- C. Portland Cement-Lime Setting-Bed Mortar: Type M complying with ASTM C270, Proportion Specification.

PART 3 EXECUTION

3.01 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove substances from substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.
- B. Verify that grades have been set properly to achieve desired finish grade elevations.
- C. Proof-roll prepared subgrade according to requirements in Section 31 22 00 Earthwork and Grading 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.

3.03 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.

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- 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 whenever possible. Hammer cutting is not acceptable.
- D. Joint Pattern: As indicated on drawings.
- E. Tolerances: Do not exceed 1/32-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet from level, or indicated slope, for finished surface of paving.
- F. Tolerances: Do not exceed 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.
- G. Work showing slope inconsistencies, birdbaths and other surface irregularities will be rejected.
- H. 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 03 30 00 "Cast-in-Place Concrete."
 - 3. Where pavers set in mortar bed are indicated as edge restraints for pavers set in aggregate setting bed, install pavers set in mortar 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.

3.04 APPLICATION

- A. Compact soil subgrade uniformly to at least 95 percent of ASTM D 698 laboratory density.
- B. 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.
- C. Place aggregate base, compact to 100 percent of ASTM D 1557 maximum laboratory density, and screed to depth indicated.
- D. Place mortar to a thickness of 1/2 to 1 inch, taking care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.
- E. 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 with pieces cut to fit from full-size unit pavers.
- F. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
- G. 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

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other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.

- H. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches of uncompacted pavers adjacent to temporary edges.
- I. Before ending each day's work, compact installed concrete pavers except for 36-inch width of uncompacted pavers adjacent to temporary edges (laying faces).
- J. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches of laying face.
- K. 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 non-staining plastic sheets to protect them from rain.
- L. 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.
- M. Do not allow traffic on installed pavers until sand has been vibrated into joints.
- N. Repeat joint-filling process 30 days later.

3.05 MORTAR SETTING-BED APPLICATIONS

- A. Saturate subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.
- B. Apply mortar bed; spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finish grades indicated.
- C. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.
- D. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform 1/16-inch-thick bond coat to mortar bed or to back of each paver with a flat trowel.
- E. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finish surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of re-aligning finished surfaces or adjusting joints.

3.06 REPAIRING, POINTING, 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.

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- B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with sand. Point joints at sealant joints to provide a neat, uniform appearance.
- C. Cleaning: Remove excess mortar from exposed paver surfaces; wash and scrub clean.

END OF SECTION

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SECTION 32 14 43 – POROUS UNIT PAVING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 RELATED SECTIONS

- A. Section 01 23 00 – Alternates, for GrassCrete paving.
- B. Section 03 30 00 – Cast-In-Place Concrete, for GrassCrete paver grid, as part of Alternate Bid.
- C. Section 31 22 00 – Earthwork and Grading
- D. Section 32 12 16 – Asphalt Paving, for adjacent paving.
- E. Section 32 14 00 – Unit Paving, for parking stall delineation and adjacent concrete unit paving.
- F. Section 32 84 00 – Irrigation, for sleeving.
- G. Section 32 91 13 – Soil Preparation, for growing medium in GrassCrete paver grid as part of Alternate Bid.
- H. Section 32 92 00 – Turf and Grasses, for grass fill as part of Alternate Bid.
- I. Section 32 93 00 – Plants, for wood header and gravel fill.

1.03 SUMMARY

- A. Section Includes:
 - 1. GrassCrete as an Alternate Bid for paving in parking lot and fire road.
 - 2. Core Gravel paving in parking lot and fire road.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.05 ACTION SUBMITTALS

- A. Product Data:
 - 1. All types of porous paving systems, including biodegradable mold materials.
 - 2. All types of sub base and setting materials.
 - 3. Fill material:
 - a. Growing medium for GrassCrete fill, as part of an Alternate Bid.
 - b. All types of crushed rock for Core Gravel fill.
 - 4. Edging material:

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- a. Wood header
 - b. Paver
- B. Sieve Analyses: For aggregate materials, according to ASTM C136.
- C. Samples:
 - 1. Aggregate setting bed materials.
 - 2. All fill materials.
 - 3. Paver

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for porous paving, indicating compliance with requirements.
- C. For grid paving units, include durability test data based on testing according to proven field performance requirements of ASTM C1319 performed on units subjected to three years' exposure to same general type of environment, temperature range, and traffic volume as Project.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified porous unit paving installer. Installer's personnel assigned to the Work shall have Concrete Paver Installer Certification from the Interlocking Concrete Pavement Institute (ICPI).
- 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. Mockups to show joints, edging, and fill material.
 - 2. Minimum size 4 feet by 4 feet.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store materials 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 can be avoided.

PART 2 PRODUCTS

2.01 POROUS PAVING SYSTEMS

- A. GrassCrete, as part of Alternate Bid – Refer to Drawings.

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- B. Core Gravel in parking lot and fire road – Refer to Drawings.

2.02 POROUS PAVER MATERIALS

- A. Source Limitations: Obtain each type of material from single source that has resources to provide materials and products of consistent quality in appearance and physical properties.
- B. Alternate Bid:
 - 1. Concrete Grid Paving: Grid paving complying with ASTM C1319, made from normal-weight aggregates.

2.03 EDGE RESTRAINTS

- A. Refer to Section 32 93 00 "Plants" for wood header.
- B. Refer to Section 32 14 00 "Unit Paving" for mortared paver edging.

2.04 AGGREGATE SETTING-BED MATERIALS

- A. Graded Aggregate for Leveling Course: Sound crushed stone or gravel complying with ASTM D448 for Size No. 8.
 - 1. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

2.05 FILL MATERIALS

- A. Aggregate Fill for Porous Paving: Graded, sound, crushed stone or gravel complying with ASTM D448 for Size No.8. Refer to Section 32 93 00 "Plants."
 - 1. Crushed rock fill in community garden: refer to Drawings.
 - 2. Crushed rock fill in parking lot and fire road: Refer to Drawings.
- B. Alternate Bid:
 - 1. Soil Fill for Porous Paving: Planting soil, refer to Section 32 91 13 "Soil Preparation."
 - 2. Grass Seed: Comply with requirements in Section 32 92 00 "Turf and Grasses."

PART 3 EXECUTION

3.01 PREPARATION

- A. Proof-roll prepared subgrade according to requirements in Section 31 22 00 "Earthwork and Grading" to identify soft pockets and areas of excess yielding. Proceed with porous paving installation only after deficient subgrades have been corrected and are ready to receive subbase and base course for porous paving.

3.02 INSTALLATION, GENERAL

- A. Do not install paving grids with chips, cracks, voids, discolorations, and other defects that might be structurally unsound or visible in finished work.

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- B. Cut units with sharp tools to provide clean, sharp, unchipped edges. full units without cutting where possible.
- C. Tolerances:
 - 1. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/16-inch unit-to-unit offset from flush.
- D. Provide edge restraints as indicated. Install edge restraints before placing porous paving.
 - 1. Install edging to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after porous paver installation.
- E. Excavate area allowing for unit thickness and top layer to meet desired finish grade.

3.03 INSTALLATION OF SETTING-BED

- A. Compact subgrade uniformly to comply with requirements described in Section 31 22 00 "Earthwork and Grading."
- B. 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.
- C. Place aggregate, compact by tamping with plate vibrator, and screed to depth indicated.
- D. 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 constant.

3.04 INSTALLATION OF PAVING UNITS

- A. Set porous paving grids on leveling course, being careful not to disturb leveling base.
- B. Alternate Bid paving installation:
 - 1. Place soil fill after porous paving has cured. Spread and screed soil fill level with tops of concrete grid. Add soil fill until porous paving is filled to about 3/4 inch from top surface; remove excess soil fill if any.
 - a. Before ending each day's work and when rain interrupts work, cover paving that has not been filled with non-staining plastic sheets to protect it from rain.
 - 2. After filling pavers with soil, sow seed according to Section 32 92 00 "Turf and Grasses." Sweep seed from surfaces of pavers into voids and water with fine spray.
 - a. Within 24 hours after sowing seed, spread an additional 1/4 of uncompacted soil fill over seed and soak with water.
- C. Place graded aggregate fill immediately after installation of porous paving grid. Spread and screed aggregate fill level with tops of pavers.
 - 1. Install infill gravel by back-dumping into the cells from buckets mounted on rubber-tired tractors. Avoid sharp turns of the tractor, driving only on gravel-filled cells.
 - 2. Spread gravel laterally from the pile using power brooms, blades, flat bottomed shovels or wide asphalt rakes to fill the cells.
 - 3. Compact gravel with a vibrating plate compactor.

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4. Before ending each day's work, place aggregate fill in installed porous paving except for 42-inch width of unfilled paving adjacent to temporary edges (laying faces).
 5. Before ending each day's work and when rain interrupts work, cover paving that has not been filled with non-staining plastic sheets to protect it from rain.
- D. Remove and replace paving that is 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.

3.05 MAINTENANCE AND PROTECTION

- A. For Alternate Bid maintenance, water newly planted grass and keep moist until grass is established. Maintain grass that is planted in paving to comply with requirements in Section 32 92 00 "Turf and Grasses."
- B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades for 30 days after planting.

END OF SECTION

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SECTION 32 15 41 – AGGREGATE PAVING WITH ADMIXTURE

PART 1 GENERAL

1.01 SCOPE

- A. Provide all material, equipment, and labor for work shown on the drawings and described below, including aggregate base and all accessories and testing required for a complete and usable product.
 - 1. Crushed aggregate blended with GraniteCrete admixture surfacing.
- B. Related Sections:
 - 1. Section 03 30 00 - Cast-in-Place Concrete, for flush concrete curbs.
 - 2. Section 06 10 63 – Exterior Rough Carpentry, for wood lumber edging.
 - 3. Section 31 00 00 – Earthwork, for grading and compaction of sub-base.
 - 4. Section 32 01 90 - Landscape Maintenance, for maintenance and repairs of paving.
 - 5. Section 32 13 13 - Concrete Paving, for adjacent concrete paving.
 - 6. Section 32 14 00 – Unit Paving, for adjacent precast concrete unit paving.
 - 7. Section 32 93 00 – Plants, for wood header edging.

1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials:
- B. ASTM D1557-00 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
- C. ASTM D2419 – Sand Equivalent Value of Soils and Fine Aggregates
- D. ASTM C136 - Method for Sieve Analysis for Fine and Course Aggregates
- E. ASTM 2434 and ASTM F2898 for aggregate permeability testing
- F. CalTrans Standard Specifications for Public Works Construction
- G. RIS – Redwood inspection Services Grades of California Redwood
- H. FSC – Forest Stewardship Council guidelines

1.03 SUBMITTALS

- A. Products Data: Provide complete product data, including sieve analysis for aggregate, admixture, and any other product used in the installation.
 - 1. Manufacturer's product data sheet and installation instruction for wet method indicating that product complies with specifications for:
 - a. Crushed aggregate blended with GraniteCrete admixture surfacing
 - b. Edging, all types

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B. Samples

1. One quart of crushed aggregate with admixture in colors specified, from manufacturer's standard color selection.

C. Mockup: Installed sample of finished paving, for approval by Landscape Architect.

1. Construct mockup of 20 square feet minimum of crushed aggregate blended with GraniteCrete admixture surfacing, including base course and edging, at location approved by Landscape Architect or Construction Manager. Demonstrate surface finish, texture, color, joints, and standard of workmanship.
2. Build mockup 21 calendar days prior to installation. Obtain approval before proceeding with rest of installation.
3. Approved mockup may remain part of final construction. Promptly remove rejected mockup from site.

D. Mix Design: Product information describing the source, color and weight of aggregate, and volume of pre-wet water.

E. Certifications:

1. Written certification from approved stabilized pavement mix manufacturer that all deliveries of natural pavement mix meet specifications. Weigh tickets for each load of natural pavement mix.
2. Redwood edging: Submit evidence of chain-of-custody in accordance with Forest Stewardship Council

1.04 POROUS BASE ROCK TESTING

A. Testing shall occur during installation at regular increments of shipping for sieve conformance. Submit results to the Construction Manager prior to completion of the stone base installation.

1. The stone field area shall have a permeable rate no less than 14 inches per hour. For 3/8-inch minus stone, the permeable rate should be 2.7 inches per hour. The testing shall be per Din 8035 Part 7, ASTM 2434 constant head, or ASTM F2898 testing methods.
2. In addition to the lab testing, after installation of any aggregate base cross-section, designed to conduct rainfall to the sub-soils and/or under-drain system, the finished aggregate base shall be tested in the field for infiltration rate, using method ASTM F2898.
 - a. Test shall be performed by a registered Geotechnical Engineer.
3. The contractor is responsible for meeting this performance specification, before proceeding with installation, and shall bear the cost of the on-site testing and the cost of any additional work necessary to achieve compliance with the specification.
 - a. The compaction rate for porous base rock should be 88 percent. The compaction rate for non-porous base rock should be 95 percent.
 - b. If at any time the processed stone base does not meet specifications, it shall be the Contractor's responsibility to restore, at his or her expense, the processed stone base to the required grade, cross-section and density.

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- c. After the Contractor has independently confirmed compliance with all the required tolerances, he or she shall notify the appropriate party and schedule a final inspection for approval.
 - 1) The Contractor shall make available an orbital laser system to the inspection team for the inspection process.
 - 2) Planarity and elevations to be verified by a licensed surveyor, and compaction, gradation and permeability to be verified by Geotechnical Engineer.
 - 4. All test results shall be logged and documented by the Owner's Geotechnical Engineer or approved Representative.
- B. Standard Specifications shall mean the California Department of Transportation Standard Specifications, latest active edition.

1.05 PROJECT/SITE CONDITIONS

- A. Field Measurements: Verify the existing site conditions; no adjustments will be made to the Contract Sum for variations in the existing conditions.
- B. Do not install crushed aggregate paving with GraniteCrete admixture surfacing when sub-base is wet at saturated field capacity. Do not install during rainy conditions.
- C. Do not install GraniteCrete materials when ambient or overnight temperature is below 40 degrees Fahrenheit.

1.06 QUALITY ASSURANCE

- A. Regulatory Requirements: Meet requirements of applicable laws, codes, and regulations required by authorities having jurisdiction over such work.
- B. Pre-installation: Coordinate, schedule and conduct a meeting to review the installation requirements with the aggregate paving manufacturer and authorized installer, Owner's Representative and specific people who will install the paving.
- C. Installer Qualifications: Installer shall be certified by the product manufacturer and shall provide evidence to indicate successful experience installing stabilized aggregate paving meeting these specifications. Evidence shall consist of a successful installation of minimum 25,000 square feet, with additional 6,000 square feet per year of decomposed granite surfacing containing GraniteCrete admixture. Include locations, dates of installation, and contact information of the owners.
 - 1. Manufacturer-certified installers can be found at <https://www.granitecrete.com/installers>.
- D. Installation: Aggregate paving manufacturer 's representative shall be on site during each step of the sample installation and site installation to oversee the installing crew and verify proper techniques are being followed.
 - 1. Materials shall comply with manufacturer's specifications.

1.07 DELIVERY, STORAGE AND HANDLING

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- A. Deliver all GraniteCrete Admixture materials in original, unopened packaging.
- B. Protect materials and aggregate from contamination with foreign matter.
- C. Store under waterproof cover and protect from dampness.

1.08 SEQUENCING

- A. Do not install work specified in this section prior to acceptance of earth moving. Coordinate work specified in this section with work specified in other sections to minimize cutting of and the operation of heavy equipment over newly installed surfacing.

1.09 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty executed by the installer agreeing to repair or replace components of surfacing that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
 - 1. Premature degradation of surface finish, including excessive sloughing of aggregate, provided the material is maintained in accordance with manufacturer's written maintenance instructions.
 - 2. Failure of system to meet performance requirements, including softening, sinking, reduced firmness.
 - 3. Manufacturer's warranty is for product only.
- C. Warranty Period: One year from date of substantial completion
- D. Contractor shall provide unconditional maintenance and repairs as required for the duration of maintenance period specified in Section 32 01 90 "Landscape Maintenance."

PART 2 PRODUCTS

2.01 CRUSHED AGGREGATE BLENDED WITH GRANITECRETE ADMIXTURE SURFACING

- A. GraniteCrete admixture is an all-natural product and does not contain oils, polymers, resins or enzymes.
 - 1. Accepted manufacturer: GraniteCrete, Inc, 800.670.0849, granitecrete.com
 - 2. Products by other manufacturers that comply with specifications will be considered in accordance with Division 00, substitution procedures.
 - 3. Refer to Drawings for admixture color
- B. DECOMPOSED GRANITE CRUSHED AGGREGATE

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1. Color: California Gold, or approved equal as selected by Landscape Architect from manufacturer's standard colors.
2. Supplier:
 - a. Lyngso Gardens, 650.354.1730
 - b. Vineyard Rock Products, 831.637.6443
 - c. Or approved equal.
 - d. Use a single supply source for the entire quantity required.
3. Decomposed granite shall have a 3/8-inch maximum gradation, produced from naturally friable granite rock with enough fines to produce a smooth walking surface. Materials should be free from clay lumps, organic matter, and deleterious material. Blends of coarse sand and rock dust are not acceptable.
 - a. Gradation in accordance with ASTM C136.
4. Crushed stone sieve analysis percentage of weight passing a square mesh sieve AASHTO T11-82 and T27-82.

<u>U.S. SIEVE NO.</u>	<u>PERCENT PASSING BY WEIGHT</u>
3/8"	100
# 4	92 – 100
# 8	70 – 85
# 16	55 – 70
# 30	40 – 50
# 50	25 – 35
# 200	10 – 15

2.02 AGGREGATE BINDER

- A. Provide GraniteCrete Admixture
 1. Color: Refer to Drawings

2.03 BASE COURSE MATERIAL

- A. Class II Permeable Base Rock
- B. Soft stone materials (i.e. sandstone, limestone, shale materials) will not be accepted. Stone supplier shall certify that all supplied stone will be clean of soft stone material.
- C. If stone stability to water and vehicles is in question, Owner has the right to perform additional testing to ensure material shall adhere to requirements of CalTrans Section 68, as well as additional applicable ASTM tests.
- D. All types of stone shall meet the following stability requirements:

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<u>TEST METHOD</u>	<u>CRITERIA</u>
LA Abrasion (California Test 211)	Not to exceed 40
Durability index (California test 229)	No less than 40

- E. All testing shall be paid for by the Contractor.
- F. Permeable stone: Stone base materials shall be washed, 100 percent fractured by mechanical means, with elongated characters on each individual particle longer than 1/4-inch. Material shall be devoid of mineral fines. All particles smaller than 1/4-inch shall be produced by manufactured means only. Rounded sands or aggregates are prohibited.
- G. Delivery Moisture Content: Processed stone shall contain 90 percent to 110 percent of the optimum moisture content to ensure that fines do not migrate in transit or during placement, and to facilitate proper compaction. The Contractor shall ensure that aggregate leaving the source plant meet this requirement. The Contractor is required to apply water to the processed stone on site to attain and maintain this minimum moisture content.
- H. Aggregate or aggregate blends of permeable stone shall conform to the following gradation:

<u>U.S. SIEVE NO.</u>	<u>SIEVE SIZE METRIC (MM)</u>	<u>PERCENT PASSING BY WEIGHT* INTENDED RESULT</u>	<u>RANGE</u>
1"	25.0	100	100
3/4"	19.0	100	90-100
3/8"	9.52	78	40-100
# 4	4.75	36	25-40
# 8	2.36	26	18-33
# 30	0.600	11	5-15
# 50	0.300	6	2-10
# 200	0.075	2	0-5

Durability Index – CTM #229: 40 min

Sand Equivalent – CTM #217: 70

LA Rattler – CTM #211: 500 Revs, less than or = 40 percent

* AASHTO Test Method T-27

- I. Specs for 3/8-inch minus and 3/4-inch minus Crushed Aggregate following ASTM D422-63/07, D1140-14:

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1. 100 percent fractured on all sides with no rounded particles
2. Sieve 200 – Non-expansive Clay Fines not to exceed 18 percent
3. The below test is for 3/8-inch minus stone, at approximately 90 percent compaction when tested:

<u>U.S. SIEVE NO.</u>	<u>PERCENT PASSING</u>	<u>SIEVE RANGE</u>
1/2"	100	100
3/8"	95	98
# 4	85	90
# 8	75	85
#16	55	70
# 30	38	57
# 50	24	33
#100	15	24
# 200	9	18
#400	0	9

2.04 ACCESSORIES

- A. Water: Free from contaminants that would discolor or be deleterious to crushed aggregate blended with GraniteCrete admixture surfacing.

2.05 EDGING

- A. Refer to Drawings.
- B. Refer to the following sections:
 1. Section 32 93 00 – Plants, for wood header.
 2. Section 03 30 00 - Cast-in-Place Concrete, for flush concrete curbs.
 3. Section 06 10 63 – Exterior Rough Carpentry, for wood lumber edging.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Installation of product shall not cause latent defects in workmanship and function. Notify the Construction Manager in writing of unsuitable conditions and conflicts.
- B. Examine grading and subsoil conditions. Do not proceed until conditions are acceptable.

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3.02 PREPARATION

- A. Excavate to depth required so edges of crushed aggregate blended with admixture surfacing will match adjacent grades and have maximum cross slope of 1 percent. Alternatively, verify that subgrades have been graded to within .05 foot of specified elevations, properly sloped for drainage, and compacted to minimum required compaction.
- B. Protection of Existing Conditions: Use every possible precaution to prevent damage to existing or newly installed work such as structures, utilities, irrigation systems, plant materials and paving on or adjacent to the site of the work, and provide barricades, fences or other barriers as required.
- C. Survey Requirements: Establish lines and levels, locate and lay out by instrumentation or other appropriate means for crushed aggregate paving finish grades. Provide a sufficient quantity of grade stakes to provide crushed aggregate paving with smooth finish grades and positive drainage.
- D. Verify that subgrade is dry, uniform, even and ready to support base material and crushed aggregate paving.
- E. Verify that edging is in place and secured to provide adequate edge support for the materials.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 SUB-GRADE PREPARATION

- A. Comply with CalTrans Standard Specifications Section 301-1 "Sub-Grade Preparation."
- B. Install Class II permeable base rock course at 90% compaction. Poorly compacted sub-base may result in failure of top layer of GraniteCrete paving.

3.04 INSTALLATION

- A. Use the Wet Method for installation.
- B. Installation Depth:
 - 1. For pedestrian sections, install in 3-inch thick lifts over a 4-inch subgrade of compacted Class II base rock.
 - 2. For light vehicular applications, install in 4-inch thick lifts over 6-inch subgrade of compacted Class II base rock.
 - 3. GraniteCrete compacts approximately 1-inch; installation prior to compaction to be 1-inch above intended finish grade.
 - 4. Install flush with adjacent edging.
- C. Mixing ratios:
 - 1. Pedestrian application, 2-bag mixture: Mix decomposed granite aggregate with GraniteCrete admixture at a ratio of 11:1; 11 units of decomposed granite to 1 unit of GraniteCrete by volume.

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2. Light vehicular application, 3-bag mixture: Mix decomposed granite aggregate with GraniteCrete admixture at a ratio of 11:1.5; 11 units of decomposed granite to 1.5 unit of GraniteCrete by volume.
- 3.
- D. After decomposed granite aggregate and GraniteCrete have been mixed but before installation has begun, mix thoroughly and moisten with water until the GraniteCrete mixture begins to marble or clump together. Squeeze the mixture in your fist and open your hand. When the color has just started to transfer onto your hand and the mixture just begins to stay together in a clump, it is ready to install.
- E. Moisten and compact Class II base rock on the entire installation area to an even depth of 4-inch to 6-inch, depending on pedestrian or vehicular application. A vibratory plate can be used to compact the base rock.
- F. Bring the prepared GraniteCrete and decomposed granite mixture to the installation location and spread the mixture over the compacted base rock.
 1. When possible, place the pre-blended mix via a single, continuous operation using a self-propelled mechanized spreading and finishing machine designed specifically for that purpose, equipped with a screen or strike-off assembly capable of being accurately regulated and adjusted to a uniform depth.
 2. Verify required thickness on drawings.
- G. Compaction:
 1. Compaction equipment:
 - a. For pedestrian thickness application: Do not use a vibratory plate to compact GraniteCrete paving. Use a lawn roller filled with water to compact the GraniteCrete paving. Use a 36-inch riding or walk-behind roller in static position for larger installations.
 - b. For light vehicular thickness application: Use vibratory plate or static riding roller after final compaction by a lawn roller
 2. Compaction rates for all applications are 88 percent to 92 percent.
 3. Initial compaction can be performed by walking on the surface, edges and corners. Rake the area until the mixture is one inch above finish grade. Ensure tight compaction.
 - a. Hand tamp around posts, corners, etc.
 4. Make several passes with a 36-inch lawn roller or walk-behind or riding roller in static position. Hand tamp any imperfections with a 6-inch wooded masonry float.
 5. Keep all tools, rollers and floats clean at all times. Fill any divots with fresh, loose material and hand tap with wood floats to match the existing finish. Remove larger stones or clumps from mixture.
 6. Begin initial compaction as soon after mix placement as mix will bear roller weight without undue displacement. If mix will not support compaction equipment due to excess moisture, delay initial compaction until mix achieves adequate stability to support compaction equipment.

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7. Test paving surface for slope and smoothness after initial rolling, and correct deficiencies immediately so that finished surface will meet specified tolerances and requirements for smoothness.
- H. Use cold joints between sections installed in separate batches. Landscape Architect to approve locations of cold joints in the field. Cold joints to be inconspicuous.
 1. Install trowelled expansion joints 10-feet apart if not shown on Drawings, or as directed by Landscape Architect in the field.
- I. Finishing: Lightly sweep finish surface with a medium bristled broom. Follow by several more passes with roller. Keep rollers clean at all times. Remove spoils off the surface immediately.
- J. Finished surface shall be of consistent quality and free of deleterious materials, including organic materials, nails, stones, and loose materials. Surface shall not have depressions or humps greater than 1/4-inch in 10 feet.
- K. Do not allow GraniteCrete to dry. Mist lightly as necessary or cover with plastic tarp.
- L. Dampen with water all newly installed and compacted GraniteCrete materials. Moisten the entire area with wide spray head; avoid puddling. Repeat surface moisture treatment 1 to 5 days after first treatment to avoid cracking. Cover with tarp on hot days to prevent drying out and cracking.

3.05 REPAIRS AND PROTECTION

- A. Remove and replace crushed aggregate paving that is damaged, defective, or does not meet requirements of this section.
- B. Protect pavement surface from damage, this includes protection against equipment and traffic until pavement has cured sufficiently to support traffic without marring, rutting, tearing, distress or damaging the pavement in any way. Provide warning signs, barricades, and protection fencing as directed by Owner's Representative to protect pavement from traffic.
 1. Do not allow traffic on installed paving mixture for 5 full days after placement or until compacted crushed aggregate blend surfacing has fully cured.
- C. Remove debris and foreign materials by mechanically blowing or hand raking the surface.
- D. Do not damage adjacent planting and irrigation systems during compaction operations.

END OF SECTION

SECTION 32 17 26 - TACTILE WARNING SURFACING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Tactile warning surfacing and accessories.
- B. Related Requirements:
 - 1. Section 32 12 16 - Asphalt Paving
 - 2. Section 32 13 13 - Concrete Paving
 - 3. Section 32 14 00 – Unit Paving

1.2 REFERENCE STANDARDS

- A. American Association of State and Highway Transportation Officials:
 - 1. AASHTO HB-17 - Standard Specifications for Highway Bridges.
- B. ASTM International:
 - 1. ASTM C1208 - Standard Specification for Vitrified Clay Pipe and Joints for Use in Microtunneling, Sliplining, Pipe Bursting, and Tunnels.
 - 2. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
 - 3. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
 - 4. ASTM D570 - Standard Test Method for Water Absorption of Plastics.
 - 5. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
 - 6. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - 7. ASTM D1044 - Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion.
 - 8. ASTM D2240 - Standard Test Method for Rubber Property - Durometer Hardness.
 - 9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 10. ASTM E303 - Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.
 - 11. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
 - 12. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
 - 13. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
 - 14. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
- C. U.S. Architectural and Transportation Barriers Compliance Board (Access Board):

1. Americans with Disabilities Act (ADA) - Accessibility Guidelines for Buildings and Facilities.

1.3 COORDINATION

- A. Coordinate Work of this Section with Work of other Sections.

1.4 PREINSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing Work of this Section.

1.5 SUBMITTALS

- A. Division 01 – Submittal Procedures: Requirements for submittals
- B. Product Data: Submit manufacturer's information including characteristics, dimensions, domes, and special shapes.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- E. Source Quality-Control Submittals: Indicate results of shop tests and inspections.
- F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- G. Manufacturer Reports:
 1. Certify that equipment has been installed according to manufacturer's instructions.
 2. Indicate activities on Site, adverse findings, and recommendations.
- H. Qualifications Statements:
 1. Submit qualifications for manufacturer and installer.
 2. Submit manufacturer's approval of installer.

1.6 QUALITY ASSURANCE

- A. Perform Work according to the 2019 California Building Code.
- B. Maintain one copy of each standard affecting Work of this Section on Site.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

- B. Installer: Company specializing in performing Work of this Section with minimum 3 years' experience and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Store and protect materials according to manufacturer's instructions.

PART 2 - PRODUCTS

2.1 TACTILE WARNING SURFACING

- A. Manufacturer List:
 - 1. Engineered Plastics, Inc. or Detectable Warning Systems, Inc.
 - 2. Furnish materials according to the 2019 California Building Code.
- B. Description:
 - 1. ADA-compliant tactile warning surfaces for visually impaired pedestrians.
 - 2. Suitable for installation on both asphalt and concrete.
- C. See Landscape Drawings for type and color.
- D. Design and Performance Criteria:
 - 1. Loading: Single-wheel HS20-44, according to AASHTO HB-17.
 - 2. Resistant to impacts, wear, freeze-thaw, UV exposure, and stains.
 - 3. Fire Spread: Less than 15 when tested according to ASTM E84.
 - 4. Slip Resistance: 0.9, according to ASTM E303.
 - 5. Taber Abrasion: 150 mgs, according to ASTM D1044.
 - 6. Durometer Hardness: 90, according to ASTM D2240, Type A.
 - 7. Water Absorption:
 - a. Comply with ASTM D570.
 - b. Maximum: 0.05 percent.
 - 8. Minimum Strengths:
 - a. Compressive: 30,000 psi, according to ASTM D695.
 - b. Flexural: 18,000 psi, according to ASTM D790.
 - c. Tensile: 19,000 psi, according to ASTM D638.
 - 9. Slip Resistance:
 - a. Dry: 1.03.

- b. Wet: 0.83.
- c. Comply with ASTM C1208.
- d. Wheelchair Safety: Furnish minimum 40, 90-degree raised points per sq. in.

10. Domes:

- a. Spacing: 23.5 inches, o.c., measured diagonally.
- b. Size: 0.9 inches base bottom diameter, 0.45 inch top diameter, 0.2 inches high.

E. Surface-Applied Mat Type:

- 1. Material: Polyurethane.
- 2. Adhesive: Pre-applied.
- 3. Edges: Beveled.
- 4. Color: Grey, selected from manufacturer's complete color range.
- 5. Anchors: Stainless steel.

F. Pre-Cast Type:

- 1. Glass-reinforced, thermoset composite.
- 2. Length and Width: 12 by 12 inches.
- 3. Depth: 1-3/8 inches.
- 4. Face Thickness: 3/16 inch.
- 5. Color: Grey, selected from manufacturer's complete color range.

2.2 SOURCE QUALITY CONTROL

- A. Provide shop inspection and testing of tactile warning surfacing units.
- B. District Inspection: Make completed tactile warning surfacing units available for inspection at manufacturer's factory prior to packaging for shipment. Notify the District at least seven days before inspection is allowed.
- C. District Witnessing: Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify District at least seven days before inspections and tests are scheduled.
- D. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
 - 1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrate is level or to correct grade, is smooth, is capable of supporting tactile warning surface units and imposed loads, and is otherwise ready to receive Work of this Section.

3.2 PREPARATION

- A. Surface Preparation:
 - 1. Clean and dry paved surface prior to installing tactile warning surface modules.
 - 2. Blow or sweep surface free of dirt, debris, oil, grease, or gasoline.

3.3 INSTALLATION

- A. Install tactile warning surfacing according to manufacturer's instructions.

3.4 FIELD QUALITY CONTROL

- A. Inspect for correct location, extent of coverage, and final grade.

3.5 CLEANING

- A. Clean tactile warning surfacing according to manufacturer's instructions.

3.6 PROTECTION

- A. Protect tactile warning surfacing from vehicular and pedestrian traffic on newly installed tactile warning surface modules for period of time as instructed by manufacturer.

3.7 MAINTENANCE

- A. Furnish service and maintenance of tactile warning surfacing for three years from date of Substantial Completion.

END OF SECTION

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SECTION 32 31 36 - BATTERY POWERED VEHICULAR BARRIER GATE

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Pre-wired barrier arm gate operator, including all selected attachments and accessory equipment. Complete with all pumps, valves, cylinders and electrical devices to move gate arm and limit its travel in both directions.

1.02 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections apply to this section.
- B. Cast in place concrete: See section 03 30 00.
- C. Electrical service and connections: See Division 26.

1.03 SUBMITTALS

- A. Shop drawings: Submit shop drawings showing connections to adjacent construction, range of travel, and all electrical and mechanical connections to the operator. All underground runs of electrical lines and inductive vehicle obstruction loop locations shall be indicated on drawings. Drawings shall also show the size and location of the concrete mounting pad.
- B. Installation instructions: Submit two copies of manufacturer's installation instructions for this specific project.
- C. Submit manufacturer's completed warranty registration form to Owner.
- D. Project list: Submit list of product installations comparable to the subject job. Include date of product installation, installer, and owner's name and location of the project.
- E. Test reports:
 - 1. Submit affidavits from the manufacturer demonstrating that the gate operator mechanism has been tested to 200,000 cycles without breakdown.
 - 2. Each operator shall bear a label indicating that the operator mechanism has been tested. Operator is tested for full power and pressure of all hydraulic components, full stress tests of all mechanical components and electrical tests of all overload devices.

1.04 QUALITY ASSURANCE

- A. Manufacturer: A company specializing in the manufacture of gate operators of the type specified, with a minimum of five years' experience manufacturing operators of this type and

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design.

- B. Installer: Must have a minimum of three years' experience installing similar equipment, provide proof of attending the manufacturer's technical training within the previous three years, or obtain other significant manufacturer endorsement of technical aptitude, if required, during the submittal process.

1.05 CODES AND REGULATORY REQUIREMENTS

- A. Operators shall be built to UL 325 standards and be listed by a nationally recognized testing laboratory.
- B. Complete all electrical work according to local codes and National Electrical Code.
- C. Vehicular gates should never be used by pedestrians. A separate pedestrian gate must always be provided when foot traffic is present.
- D. Current safety standards require gate operators to be designed and labeled for specific usage classes.
 - 1. System shall be listed for use in UL 325 Usage Classes: I, II, III, IV.
- E. NOTE: To be compliant with UL 325 and Industry safety guidelines, additional entrapment protection devices may need to be installed with this gate operator if the moving arm will travel within 16" of a stationary object.

1.06 PRODUCT DELIVERY AND STORAGE

- A. Store products upright in the original shipping containers, covered, ventilated and protected from all weather conditions.

1.07 WARRANTY

- A. Provide a warranty against all defects in materials or workmanship for five years or 500,000 gate cycles (whichever occurs first) after the date of installation. Defective materials shall be replaced at manufacturer's discretion with new or reconditioned materials furnished by the manufacturer, at no cost to the owner. Freight, labor and other incidental costs are not covered under the factory warranty, but may be covered by a separate service agreement between installing company and the owner.
 - 1. To ensure validation of warranty, complete warranty registration form online at manufacturer's website. Warranty registration form is also included in the printed materials shipped with the operator.

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PART 2 – PRODUCTS

2.01 GATE OPERATORS

- A. Basis of Design: HySecurity gate operator model StrongArm 20 UPS (HTG 320-3 DC ST) with Smart Touch Controller.
- B. Acceptable Alternative Manufacturers:
 - 1. R&S Doors.
 - 2. DoorKing.

2.02 OPERATION

- A. Operation shall be by means of a hydraulic cylinder pulling a crank arm that rotates the output through 90°. Operation to the fully open and fully closed position shall be limited by cam operated switches that accurately read the position of the shaft and arm. Spring counterbalance shall not be required. Gears, sprockets, or belts shall not be incorporated in the operator. All models include two brake valves to gradually stop and hold the arm without applying a shock load to the arm or operator assembly. Travel time not to exceed three seconds from fully closed to fully open position.
- B. Minimum standard mechanical components:
 - 1. Chassis: shall be 10 gauge zinc plated steel, welded, and edges ground smooth.
 - 2. Cover: shall be 14 gauge zinc plated steel, with all joints welded, filled and ground smooth.
 - 3. Output shaft: shall be 1 1/4" diameter, high strength steel alloy.
 - 4. Crank arm: shall be made of 3/4" plate steel.
 - 5. Heavy duty sealed 1 1/4" bearings, with 4 bolt mounting flanges.
 - 6. Adjustable physical stop limiting close travel to prevent arm from sagging below a level position.
 - 7. Counterweights: shall be used for any arm 20 ft and longer and utilize a yoke assembly to evenly distribute load.
 - 8. Hydraulic hose: Shall be 1/4" synthetic, rated to 3,000 psi.
 - 9. Hydraulic fluid: High performance type with a viscosity index greater than 375 and temperature range -40° F to 158° F.

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10. Manual operation: in the event of a power outage the use of a "pull to release" bypass valve shall unlock the operator and allow the arm to be moved by hand.
11. Arm striping: shall be highly reflective alternating red and white vertical stripes, 16" intervals measured horizontally per MUTCD standards.
12. Finish: Textured TGIC polyester powder coat finish in Custom Gray Color, selected from manufacturer's standard color range, proven to withstand 1,000 hour salt spray test.

C. Minimum standard electrical components:

1. Pump motor: 3/4 hp, 1800 RPM, 56C, TEFC, 24 VDC motor.
2. All components shall have overload protection.
3. Electrical enclosure: Type 1, metal, with hinged lid gasketed for protection from intrusion of foreign objects.
4. Controls: Smart Touch Controller Board containing:
 - a. Bi-directional traffic mode;
 - b. Built in timer to close;
 - c. 32 character OLED display for reporting of functions and codes;
 - d. Multiple programmable output relay options;
 - e. Anti-tailgate mode;
 - f. Built-in power surge/lightning strike protection;
 - 1) Menu configuration, event logging and system diagnostics easily accessible with a PC manufacturer's software;
 - 2) RS-232 port for connection to laptop or other computer peripheral and RS-485 connection for network interface.
 - g. Dual gate communication connection for bi-parting, sally port, or sequenced gates.
 - h. Electromechanical and solid state relays.
 - i. Radio option outputs.
 - j. 21 inputs for site specific configurations.
5. Control circuit: 24 VDC.

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6. Low voltage sensor to protect batteries from over discharge. Last operation can be programmed for fail secure or fail open.
 7. AC power loss operation: the operation can be programmed to open immediately or stay open after next normal operation, or remain in normal operation until batteries are low.
 8. Permanently sealed, maintenance free, lead acid batteries in separate insulated and ventilated enclosure.
 9. Battery enclosure is Type 3R 30" x 30" x 12", ANSI 61 gray polyester powered paint finish over galvanized steel.
 10. 50A, fully automatic, regulated battery charger.
 11. Limit switches shall be adjustable to control maximum travel.
- D. External sensors for stopping or reversing the barrier or arm travel: photo-eyes.
- E. Control devices: free egress vehicle detectors, vehicle obstruction loop detectors, reset loop, keypads, and Knox boxes or similar emergency vehicle open devices as dictated by local code.
- F. Other options:
1. Optional "Warn before operate buzzer"
 2. Through Beam or Reflective type photo eyes.
 3. Plug in type vehicle detectors.
 4. 208/230 VAC 50/60 Hz single phase only
 5. Optional stainless steel fasteners.
 6. Low voltage lights for barrier arm and/or optional flasher.
 7. Custom color chassis and cover: Zinc plated and primer painted with textured finish coat.
 8. Brushed finish stainless steel cover with hot dipped galvanized chassis for marine, caustic, or other extreme environments.
 9. 2" x 5" single piece aluminum arm up to 20 ft

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2.03 FACTORY TESTING

- A. Fully assemble and test each gate operator at the factory to assure smooth operation, sequencing and electrical connection integrity.
- B. Proof test with simulated physical and electrical loads to exceed the fully rated capacity of the operator components.
- C. Inspect and test all hydraulics are leak free.
- D. All testing data shall be individually logged and recorded by serial number.
- E. Check all mechanical connections for tightness and alignment. Check all welds for completeness and continuity.
- F. Inspect finishes for completeness. Touch up imperfections prior to shipment.
- G. Check all hydraulic hoses and electrical wires to assure that chafing cannot occur during shipping or operation.

PART 3 – EXECUTION

3.01 SITE EXAMINATION

- A. Locate concrete mounting pad in accordance with approved shop drawings and in compliance with applicable building codes.

3.02 INSTALLATION

- A. Install gate operator in accordance with the safety regulations and the manufacturer's product literature and installation instructions, current at the time of installation. Coordinate locations of operators with contract drawings; other trades and shop drawings.
- B. Installer shall ensure that the electrical service to the operator is at least 20A. Electrical wiring to conform to NEC and manufacturer's installation instructions. Standard UPS is 2200W.

3.03 FIELD QUALITY CONTROL

- A. Test operator through ten full open and close cycles and adjust for operation without binding, scraping or uneven motion. Test limit switches for proper open and close limit positions.
- B. All anchor bolts shall be fully tightened in the finished installation.
- C. Owner, or owner's representative, shall complete "punch list" with installing contractor prior to final acceptance of the installation and submit completed warranty documentation to

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manufacturer.

3.04 CONTINUED SERVICE AND DOCUMENTATION

- A. Train owner's personnel on how to safely shut off electrical power, release and manually operate the barrier. Additionally, demonstrate the general maintenance of the gate operator and accessories and provide one copy of "Programming and Operations Manual" for the owner's use. Manuals will identify parts of the equipment for future procurement. Direct maintenance personnel to the technical support sections on manufacturer's website.

END OF SECTION

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SECTION 32 84 00 - IRRIGATION

PART 1 GENERAL

1.01 SUMMARY

- A. The Contractor shall provide all labor, materials, supplies, tools, and transportation and perform all operations in connection with and reasonably incidental to complete the installation of the automatic sprinkler irrigation systems as shown on the drawings. Items hereinafter are included as an aid to take off, and are not necessarily a complete list of work items.
 - 1. Trenching, stockpiling, excavation, materials, and refilling trenches.
 - 2. Furnishing materials and installation for complete system including piping, valves, fittings, sprinkler heads, automatic controls, and final adjustment of heads to insure complete coverage.
 - 3. Line voltage connections to the irrigation controllers and low voltage control wiring from controllers to remote control valves.
 - 4. Replacement of unsatisfactory materials.
 - 5. Clean-up, inspection and approval.
 - 6. All work of every description mentioned in the specification and/or addenda thereto, all other labor, and materials reasonably incidental to the satisfactory completion of the work, including clean-up of the site, as directed by the Project Representative.
 - 7. Tests.
 - 8. As-built record drawings.

1.02 RELATED SECTIONS

- A. Section 03 30 00 – Cast-In-Place Concrete, for sleeving in planters
- B. Section 04 22 00 – Concrete Unit Masonry, for sleeving in planters
- C. Section 32 13 14 – Landscape Concrete Paving, for sleeving
- D. Section 32 92 00 – Turf and Grasses, for grass planting requirements
- E. Section 32 93 00 – Plants, for planting requirements
- F. Section 33 47 27 – Bioretention, for bioretention areas and rain gardens
- G. Division 22 – Plumbing
- H. Division 26 – Electrical

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer catalog information on all material to be used on the project as specified on the legend, notes, details and plans. Redline or highlight exact items on page to be submitted. Complete material list shall be submitted prior to performing any work.
- B. Substitutions: No substitution will be permitted without prior written approval by the Project Representative. If the product is approved and, in the opinion of the Project Representative,

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the substituted product does not perform as well as the specified product, the Contractor shall replace it with the specified product at no additional cost to the Project Representative.

- C. All equipment or materials installed or furnished without prior approval of the Project Representative may be rejected and the Contractor may be required to remove the equipment or material at their own expense.

1.04 CLOSEOUT SUBMITTALS

- A. Project As-built Record Documents: The Contractor shall maintain in good order in the field office, one complete set of black line prints of all sprinkler drawings which form a part of the contract, showing all water lines, electrical, sprinklers, valves, stub-outs. In the event any work is not installed as indicated on the drawings, such work shall be corrected and dimensioned accurately from the building walls. All underground stub-outs for future connections and valves shall be located and dimensioned accurately from building walls on all as-built record drawings. In addition to the hard copies a full sized scanned PDF will be required at completion.
- B. Controller Chart:
 - 1. Provide one laminated controller chart showing the area covered by controller for each automatic controller supplied at the maximum size controller door will allow. Chart shall be a reduced drawing of the actual "as-built" system. If controller sequence is not legible when the drawing is reduced to door size, the drawing shall be enlarged to a size that is readable and placed folded, in a sealed plastic container, inside the controller door.
 - 2. Controller chart shall be a blackline print with a different color used to show area of coverage for each station. Charts must be completed and approved by the Project Representative prior to final inspection of the irrigation system.
- C. Maintenance and Operating Instructions and Manuals:
 - 1. Contractor shall prepare an Operation and Maintenance Manual, organized in a 3-ring binder, containing the following information.
 - 2. Contractor's name, address, and telephone number. Duration of guarantee, periods as specified herein, list of equipment with names and addresses of local manufacturer's representatives with duration of written warranties. Complete operating and maintenance instructions on all equipment spare parts lists and related manufacturer's information.
 - 3. Submit the Operation and Maintenance Manual to the Project Representative within 10 Calendar Days of completion of work of this Section and as a condition of project acceptance.
- D. Controller Cloud Based Communication and Flow Sensor installation confirmation:
 - 1. Provide written confirmation that the cloud-based communications are set up and operational between controller(s) and cloud-based server.
 - 2. If controller is a two-wire type controller. Provide confirmation that the controller is communicating with each decoder valve on system and there are no error messages logged on the cloud-based communication system. Provide a printout of information to Landscape Architect or Irrigation Consultant.
 - 3. Provide written confirmation from the distributor/manufacturer's representative that the controller is communicating with flow sensors and that the correct "k" and "offsets" are setup and utilized properly. The "k" and "offsets" are pre-set numbers you plug into the controller software based on the flow sensor size and type when calibrating the flow sensor. Confirm that flow values have been "learned" and recorded for each valve on the controller, and the correct gpm per valve is shown and verified on a printout and

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provided to Landscape Architect or Irrigation Consultant. Flow alarms and automatic shut offs should be set up after plant establishment.

1.05 IRRIGATION AUDIT, IRRIGATION SURVEY, AND IRRIGATION WATER USE ANALYSIS

- A. All landscape irrigation audits shall be conducted by a local agency landscape irrigation auditor or a third party certified landscape irrigation auditor. Landscape audits shall not be conducted by the person who design the landscape or installed landscape.
- B. In large projects or projects with multiple landscape installations (i.e. production home developments) an audit rate of 1 to 7 lots or approximately 15% will satisfy this requirement.
- C. For new construction and rehabilitated landscape projects installed after December 1,2015, as described in Section 490.1:
- D. the project applicant shall submit an irrigation audit report with the Certificate of Completion to the local agency that may include, but is not limited to: inspection, system tune-up, system test with distribution uniformity, reporting overspray or run off that causes overland flow, and preparation of an irrigation schedule, including configuring irrigation controllers with application rate, soil types, plant factor, slop, exposure and any other factors necessary for accurate programming.

1.06 QUALITY ASSURANCE & GENERAL REQUIREMENTS

- A. Qualifications: The Contractor, personally or through an authorized and competent representative, shall supervise the work constantly, and shall as far as possible keep the same foreman and workmen on the job from commencement to completion. The workmanship of the entire job must in every way be first class, and only experienced and competent workmen will be allowed on the job. A minimum of five years' experience of installing irrigation systems of similar scope, size and complexity as the system being installed under this scope of work is required for all on-site job superintendents.
- B. Manufacturer's installation instructions and best practices: Manufacturer's installation instructions shall be followed in all cases when not shown in the Drawings or Specifications.
- C. S.H.A. Compliance: All articles and services covered by this specification shall meet or exceed the safety standards established under the Federal Occupational Safety and Health Act of 1970, together with all amendments in effect as of the date of this specification.
- D. All irrigation systems shall be installed to meet or exceed the requirements set forth in the California Department of Water Resources Model Water Efficient Landscape Ordinance.
- E. Codes and Standards: Comply with all applicable codes and standards.
 - 1. All work and materials shall be in full accordance with the latest rules and regulations of the National Electric Code; published by the Western Plumbing Officials Association; California Code of Regulations, Title 23, Division 2. Department of Water Resources, Chapter 2.7. Model Water Efficient Landscape Ordinance; and other State or local laws regulations. Nothing in these drawings or specifications is to be construed as to permit work not conforming to these codes.
 - 2. When the specifications call for materials or construction of a better quality or larger size than required by the above mentioned rules and regulations, the provision of the specifications shall take precedence over the requirements of said rules and regulations.

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3. Contractor shall furnish, without extra charge, any additional material and labor when required by the compliance with these rules and regulations, though the work be not mentioned in these particular specifications or shown on the drawings.
4. The Contractor shall erect and maintain barricades, guards, warning signs, and lights as necessary or required by O.S.H.A. regulations for the protection of the public or workmen.
5. Any existing buildings, equipment, piping, pipe covering sewers, etc., damaged by the Contractor during the course of his work shall be replaced or repaired by the Contractor in a manner satisfactory to the Project Representative and at Contractor's own expense, before final payment is made. The Contractor shall be responsible for damage caused by leaks in the piping systems being installed or having been installed under this contract. He/she shall repair, at his/her own expense, all damage so caused, in a manner satisfactory to the Project Representative.
6. The Contractor shall pay for all permits, licenses, and fees required.

1.07 EXISTING CONDITIONS

- A. Protection of Existing Structures and Utilities
 1. The Drawings show, if applicable, existing above and below grade structures and utilities that are known to the Project Representative. Locate known existing installations before proceeding with construction operations that may cause damage to such installations. Existing installations shall be kept in service where possible and damage to them shall be repaired with no adjustment of Contract Sum. Verify with Project Representative if As Built drawings are available.
- B. If other structures or utilities are encountered, request Project Representative to provide direction on how to proceed with the Work. If a structure or utility is damaged, take appropriate action to ensure the safety of persons and property.
- C. Trench Interference with Existing Tree Root Systems: Prior to trenching, layout main and lateral line locations within drip Line of trees and review locations with Project Representative. Relocate any lines that may interfere with existing root systems to avoid or reduce damage to root systems as accepted by Project Representative.
- D. Provide barricades, coverings, warning signs, lights and other protection required by local code or OSHA to prevent damage to existing improvements to remain and to protect the public.

1.08 LAYOUT OF WORK

- A. The Contractor shall stake out the irrigation system as shown on the drawings. These areas shall be checked by the Contractor and Project Representative before construction is started. Any changes, deletions or additions shall be determined at this check.
 1. Due to the scale of the Drawings, it is not possible to indicate all piping offsets, fittings, sleeves, etc., which may be required. Carefully investigate the conditions affected all of the work and plan accordingly, and furnish all required fittings. Install system in such a manner to avoid conflicts with planting, utilities and architectural features.
 2. Do not install the irrigation system as shown on the Drawings when it is obvious in the field that obstructions, grade differences or discrepancies in arc dimensions exist that might not have been considered. Bring such obstruction or differences to the attention of the Project Representative. Notify and coordinate irrigation Work with applicable contractors for location and installation of piping and sleeves through or under walls,

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pavement and structures. In the event this notification is not given, the Contractor shall assume full responsibility for any revision necessary.

1.09 SEQUENCING AND SCHEDULING

- A. Acceptance: Do not install main line trenching prior to acceptance by Project Representative of rough grades completed under another Section.
- B. Coordination: Coordinate with the all other trades the sleeving, power requirements of the project, prior to the start of construction.

1.10 INSTRUCTION

- A. After the system has been installed and approved, the Contractor shall instruct the Project Representative and or Maintenance Contractor, in complete operation and maintenance of the irrigation system.

PART 2 MATERIALS

2.01 PIPE AND FITTINGS

- A. Main lines (constant pressure); 2.5" and smaller shall be PVC 1120-Schedule 40 plastic pipe. Pipe shall be made from NSF approved Type 1, Grade 1 PVC compound conforming to ASTM D1785.
 - 1. Solvent weld main lines: At changes in direction or branch mains, use appropriate Schedule 40 PVC solvent weld fittings as approved by the Uniform Plumbing Code.
- B. Lateral lines (non-pressure): 3/4" and larger shall be 1120-Schedule 40 PVC plastic pipe. All lateral lines shall be connected with Schedule 40, Type I, Grade I, PVC solvent weld fittings.
- C. Connections between main lines and RCV's shall be of Schedule 80 PVC (threaded both ends) nipples and fittings.
- D. Risers shall be as follows:
 - 1. Schedule 80 PVC threaded nipples and Schedule 80 PVC ells as shown in the construction details. Offset risers shall be Cobra connector Model CC-600 (1/2"x6").

2.02 BACKFLOW PREVENTION DEVICE

- A. Refer to Drawings.

2.03 GATE VALVES

- A. Gate valves 2.5" and smaller shall meet the following requirements:
 - 1. Valves shall be of stainless steel (304 or higher) construction with non-rising stem, cross handle and threaded connections.
 - 2. Valves shall be Leemco Model #LGT-SS or approved equal. Size as shown on the drawings
 - 3. Install in 10" diameter plastic valve box as detailed.

2.04 QUICK COUPLING VALVES

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- A. Quick coupling valves shall be as shown on the drawings. Install in 10" diameter plastic valve box as detailed.

2.05 CONTROLLERS

- A. Refer to Drawings

2.06 CONTROL WIRE

- A. Control wire shall be copper with U.L. approval for direct burial in ground, size #14- Common ground wire shall have white insulating jacket; control wire shall have insulating jacket of color other than white or yellow. Runs over 2,000 lineal feet shall be #12- AWG-UF 600 volt copper wire. Splices shall be made with 3M-DBY seal packs.
- B. Provide a separate ground wire for each controller.
- C. Provide a minimum of two spare control wires into each RCV box for future. Spare wires shall be yellow.

2.07 ELECTRIC REMOTE CONTROL VALVES

- A. Electric remote control valves sizes shall be shown on drawings.
- B. Electric remote control valve shall be a normally closed 24 VAC solenoid actuated globe pattern valve.
- C. Valves shall be made of durable glass-filled nylon with a pressure rating of 200 PSI
- D. Valve shall have external and internal bleed for manual operation.
- E. Provide and install one Schedule 80 PVC FIPT threaded true union ball valve with EPDM O-rings on the upstream side of valve and one Schedule 80 union on the downstream side of valve. Ball valve shall be Spears True Union model 2300. Match valve size when sizing ball valve and union.
- F. All electric remote control valves for dripline or drip systems shall include a wye filter with a 200 mesh stainless steel screen and pressure regulator on the valve or downstream of the valve.

2.08 IDENTIFICATION TAG

- A. Identification tags for all electric control valves shall be manufactured by Christy. Tag numbers shall match stationing in controller and as shown on as-built drawings. Provide one yellow station number tag for each electric control valve as follows:
 - 1. Potable water systems: Christy ID.STD.Y1

2.09 VALVES BOXES

- A. Refer to Drawings

2.10 ELECTRIC REMOTE CONTROL VALVE BOXES

- A. All electric remote control valve boxes that service non-drip systems shall be installed within a NDS Pro Series Model 214BC, 213BCBLK (14"x19") or 221BCB, 222BCB BLK (13" x 24")

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plastic valve box with bolt down plastic lid or approved equal. Size of box is dependent on the size of valve. Lid shall be marked: "Irrigation Control Valve."

- B. All electric remote control valve boxes that service dripline or drip systems shall be installed within a NDS Pro Series Model 221 BCB (13" x 24") plastic valve box with bolt down plastic lid or approved equal. Lid shall be marked: "Irrigation Control Valve."
- C. Use black colored boxes in shrub and groundcover areas and green in turf areas.
- D. Heat brand controller letter and numbers into lid. Minimum text height to be 2".

2.11 GATE VALVE AND QUICK COUPLING VALVE BOXES

- A. All gate valve and quick coupling valve shall be installed within a NDS Pro Series Model 212BCB or 211BBCBLK plastic valve box with plastic lid or approved equal. Use 8" sleeve to encase gate valve.
- B. Use black colored boxes in shrub and groundcover areas and green in turf areas.
- C. Heat brand the letters "GV" into lid. Minimum text height to be 2".

2.12 DRIP COMPONENT BOXES

- A. All drip components shall be installed within a 6" round black plastic valve box with plastic lid. NDS Standard Series Model 107BC plastic valve box with plastic lid or approved

2.13 SPRINKLER HEADS AND BUBBLERS

- A. All sprinkler heads shall be as listed on the drawings.
- B. Pop-up spray sprinklers shall include a built in check valve in the body to hold up to 14 feet of head.
- C. Pop-up spray sprinklers shall include built in pressure regulation in the body.
- D. Use 30 psi regulators for all spray nozzles and 45 psi regulators for all rotating nozzles. Use 12" pop-ups in shrub and ground cover areas and 6" pop-ups in turf areas.
- E. Riser units and nipples shall be the same size as the inlet to the sprinkler body.

2.14 DRIPLINE & DRIPLINE COMPONENTS

- A. Dripline shall be as listed on the drawings.
- B. Tubing shall be low density, UV resistant, polyethylene tubing with internal pressure-compensating, drip emitters impregnated into the tubing spaced at 12 or 18 inches
- C. The built in emitters shall be capable of delivering 0.6 gallons per hour per emitter.
- D. All dripline systems shall have a manual flush valve at each isolated zone within the systems. Multiple flush valves may be required per drip zone.
- E. All dripline systems shall have air relief valve(s) at the highest elevation point(s) within each isolated zone. Install one air relief valve for every 500 linear feet of dripline.

2.15 CHECK VALVE

- A. Spring check valve shall be Schedule 40 PVC with ½ lb spring and stem rated at 150 PSI.

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- B. Check valves shall be NDS. Use KSC series swing check valve for all uphill flow direction valves and KC series spring check for all downhill flow direction valves. Size per line size of lateral line.

2.16 MISCELLANEOUS INSTALLATION MATERIALS

- A. Solvent cement and primer for solvent weld joints shall be of make and type approved by manufacturer(s) of pipe and fittings. Cement shall be maintained at proper consistency throughout use.
- B. Pipe joint compound shall be non-hardening, non-toxic materials designed specifically for use on threaded connections in water carrying pipe. Performance shall be same as RectorSeal #5.

2.17 MISCELLANEOUS EQUIPMENT

- A. Provide all equipment called for by the drawings.
- B. Provide to the Project Representative at completion of the maintenance period, three (3) each of all operating and servicing keys and wrenches required for complete maintenance and operation of all heads and valve. Include all wrenches necessary for complete disassembly of all heads and valves.

PART 3 EXECUTION

3.01 PREPARATION

- A. Schedule and coordinate placement of materials and equipment in a manner to effect the earliest completion of work in conformance with construction and progress schedule.

3.02 HANDLING AND STORAGE

- A. Protect work and materials from damage during construction and storage as directed by the Project Representative.
- B. Handle plastic pipe carefully; especially protect it from prolonged exposure to sunlight. Any section of pipe that has been damaged will be discarded and removed and replaced if installed.

3.03 LAYOUT

- A. Lay out work as accurately as possible in accordance with diagrammatic drawings.
- B. Where site conditions do not permit location of piping, valves and heads where shown, notify Project Representative immediately and determine relocation in joint conference.
- C. Prior to installation, the Contractor shall stake out the routing of all pressurized main lines and sprinkler heads for approval by Project Representative.
- D. Run pipelines and automatic control wiring in common trenches wherever practical.

3.04 EXCAVATING AND TRENCHING

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- A. Excavation shall be in all cases ample in size to permit the pipes to be laid at the elevations intended and to permit ample space for joining.
- B. Make trenches for pipelines deep enough to provide minimum cover from finish grade as follows:
 - 1. 18" minimum cover over main lines to control valves and quick coupling valves.
 - 2. 18" minimum cover over control wires from controller to valves.
 - 3. 12" minimum cover over RCV controlled lateral lines to sprinkler heads.
- C. Restore surfaces, existing underground installations, etc., damaged or cut as a result of excavations, to original conditions in a manner approved by the Project Representative.
- D. Where other utilities interfere with irrigation trenching and pipe work, adjust the trench depth as instructed by the Project Representative.

3.05 ASSEMBLING PIPELINES

- A. All pipe shall be assembled free from dirt and pipe scale. Field cut ends shall be reamed only to full pipe diameter with rough edges and burrs removed.
- B. Install plastic pipe in accordance with manufacturer's recommendations.
- C. Install 3" wide detectable warning tape above all pressurized main lines as shown in the details. Use Christy model #TA-DT-3-BIRR for potable irrigation systems
- D. Solvent Weld Joint:
 - 1. Prepare joint by first making sure the pipe end is square. Then, de-burring the pipe end, and clean pipe and fitting of dirt, dust and moisture.
 - 2. Dry insert pipe into fitting to check for proper sizing. Pipe should enter fitting 1/3 to 2/3 depth of socket.
 - 3. Coat the inside socket surface of the fitting and the male end of the pipe with P-70 primer (manufactured by Weld-On). Then without delay, apply Weld-On 711 cement liberally to the male end of the pipe and also apply 711 cement lightly to the inside of the socket. At this time, apply a second coat of cement to the pipe end.
 - 4. Insert pipe immediately into fitting and turn 1/4 turn to distribute cement and remove air bubbles. The pipe must seat to the bottom of the socket and fitting. Check alignment of the fitting. Pipe and fitting shall be aligned properly without strain to either.
 - 5. Hold joint still for approximately thirty (30) seconds and then wipe the excess cement from the pipe and fitting.
 - 6. Cure joint a minimum of thirty (30) minutes before handling, at least six (6) hours before allowing water in the pipe.
- E. Threaded Joint:
 - 1. Field threading of plastic pipe or fittings is not permitted. Only factory formed threads will be permitted.
 - 2. Factory made nipples shall be used wherever possible. Field cut threads in metallic pipe will be permitted only where absolutely necessary. When field threading, cut threads accurately on axis with sharp dies.
 - 3. All threaded joints shall be made up with pipe joint compound. Apply compound to male threads only.
 - 4. Where assembling metallic pipe to metallic fitting or valve, not more than three (3) full threads shall show when joint is made up.

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5. Where assembling to threaded plastic fitting, take up joint no more than one full turn beyond hand tight.
 6. Where assembling plastic pipe, use strap type friction wrench only; do not use metal-jawed wrench.
- F. Cap or plug openings as pipeline is assembled to prevent entrance of dirt or obstructions. Remove caps or plugs only when necessary to continue assembly.
 - G. Where pipes or control wires pass through sleeves, provide removable non-decaying plug at ends of sleeve to prevent entrance of earth.

3.06 REMOTE CONTROL VALVES

- A. Install where shown on drawings and group together where practical. Limit one remote control valve per box. No exceptions!
- B. Locate valve boxes 12" from and perpendicular to walk edges, buildings and walls. Provide 12" between valve boxes where valves are grouped together.
- C. Thoroughly flush main line before installing valves.
- D. Install in shrub or groundcover areas where possible.
- E. Label control line wire at each valve with an I.D. tag, indicating identification number of valve (controller and station number). Attach label to control wire.
- F. Flow control stems shall be adjusted or tuned per manufacturer recommendations.

3.07 AUTOMATIC CONTROL WIRE

- A. Run lines along mains wherever practical. Tie wires in a bundle with pipe wrapping tape at 10' intervals and allow slack for contraction between strapping.
- B. Loop a minimum of three (3) feet of extra wire in each valve box.
- C. Connections shall be made by crimping bare wires with brass connectors and sealing with watertight resin sealer packs per manufacturer specifications.
- D. Splicing will be permitted only on runs exceeding 2500'. Locate all splices within valve boxes or splice box.

3.08 AUTOMATIC CONTROLLER

- A. Install at eye level in locations indicated on Drawings, and as directed by Landscape Architect.

3.09 BUBBLERS, SPRINKLER HEADS AND QUICK COUPLING VALVES

- A. Thoroughly flush lines before installing heads, bubblers or QCV's.
- B. Locate bubblers, heads and QCV's as shown in the drawings and details.
- C. Adjust sprinkler heads for proper distribution and trim.
- D. Install lawn heads 1" above grade in seeded lawn area at time of installation. Lower to finished grade after turf is well established and as directed by Project Representative.

3.10 DRIPLINE AND DRIPLINE COMPONENTS

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- A. Thoroughly all flush lines driplines.
- B. Install dripline a minimum of 12" away from all buildings and 6" off hardscapes for shrubs and groundcover. 2" of paving for all no-mow or sod type grasses.
- C. Space driplines equally throughout the planting area as detailed. Refer to legend for emitter and row spacing of dripline. Adjust alternate rows so emitters are spaced in a triangular pattern.
- D. All dripline tubing shall be buried 4" below finish grade and stapled down every 4' and at each change in direction with a 6" tubing stake.
- E. For slopes greater than 10:1, modify dripline row spacing on the bottom 1/3 of the slope to be 25% greater at the bottom of the slope.
- F. Install flush valves at the low end of each drip zone minimum of 2 valves are required for each valve. Refer to manufacturer details for installation instructions.
- G. Install air vacuum relief valve(s) at high point(s) of each planting area. Refer to drawings for approximate locations. Revise locations in field based on actual grades of the site. Locate 1 valve per every 500' of dripline. Refer to manufacturer details for installation instructions.
- H. Thoroughly saturate soil prior to planting. Provide additional surface watering as required to keep plant root systems moist during planting establishment period.

3.11 BACKFILLING

- A. Backfill only after piping and wire has been inspected and approved.
- B. Backfill material shall be the earth excavated from the trenches, free from rocks, concrete chunks, and other foreign or coarse materials.
- C. Place backfill materials in 6" layers and compact by jetting or tamping to a minimum compaction of 90 percent of original soil density.
- D. Dress off areas to finish grade and remove excess soil, rocks, or debris remaining after backfill is completed.
- E. If settlement occurs along trenches, and adjustments in pipes, valves, and sprinkler heads, soil, sod, or paving are necessary to bring the system, soil, sod, or paving to the proper level or the permanent grade, the Contractor, as part of the work under this contract, shall make all adjustments without extra cost to the Project Representative.

3.12 FIELD QUALITY CONTROL

- A. Coverage Tests:
 - 1. Perform coverage tests in the presence of Project Representative, after sprinkler or drip system is completed. Test system to assure that all areas are irrigated completely and uniformly.
 - 2. Do not spray onto pavement or structures. Adjust arc nozzles as needed to provide full coverage without over spray.
- B. Adjusting and Cleaning:
 - 1. System adjustment:
 - a. Valves: Adjust flow for proper operation.
 - b. Heads: Adjust for alignment and coverage.

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- c. If it is determined that coverage could be improved by adding additional driplines or a nozzle change, make such changes as required to provide adequate coverage to all plant material.
- d. Perform final cleaning of all risers, dripline, heads, and equipment for proper operation. Demonstrate operation and uniform coverage in the presence of the Project Representative prior before final acceptance.

3.13 TESTING

- A. Perform test as specified below. Remake any faulty joints with all new materials. Use of cement or caulking to seal leaks is absolutely prohibited.
- B. Contractor shall:
 1. Notify the Project Representative at least three (3) days in advance of testing.
 2. Perform testing at his/hers own expense.
 3. Center load piping with small amount of backfill to prevent arching or slipping under pressure. No fitting shall be covered
 4. Apply the following tests after welded plastic pipe joints have cured at least twenty-four (24) hours.
 - a. Solvent Weld Mainline: Remove all the air from the piping system then test live (constant pressure) and QCV lines hydrostatically at 125 PSI minimum. Lines will be approved if test pressure is maintained for six (6) hours. The lines shall be restored to the original test pressure. The Contractor shall make tests and repairs as necessary until test conditions are met.
 - b. Test RCV controlled lateral lines with water at line pressure and visually inspect for leaks. Retest after correcting defects.

3.14 GUARANTEE

- A. It shall be the responsibility of the Contractor to fill and repair all depressions and replace all necessary lawn and planting due to the settlement of irrigation trenches for one year following completion and acceptance of the job.
- B. The Contractor shall also guarantee all materials, equipment and workmanship furnished by him to be free of all defects of workmanship and materials, and shall agree to replace at his expense, at any time within one year after installation is accepted, any and all defective parts that may be found.

3.15 MAINTENANCE

- A. Continuously maintain irrigation system in areas indicated in the Contract during the progress of work and for a period of 90 days after substantial completion.
- B. It is Contractor's responsibility to turn over the irrigation in a first-class condition at the end of the maintenance period.
- C. Maintenance Schedule: Contractor shall submit schedule of maintenance tasks to be performed for Project Representative review and approval. At a minimum, maintenance staff shall be on-site two times per month. It is not the intention of these Specifications to allow a "quick cleanup" at the end of the maintenance period, but rather that the work be continuous and ongoing.

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- D. Proper irrigation system maintenance includes the overall supervision of the system, controller scheduling, routine adjustments and necessary repairs.
- E. Maintain irrigation system for optimum performance, as per manufacturer's specifications, by inspecting the entire system on an on-going basis. This includes cleaning and adjusting all bubbler heads, dripline and valves for proper coverage

3.16 CLEAN-UP

- A. When work of this section has been completed and at such other times as may be directed, remove all trash, debris, surplus materials, and equipment from site.

END OF SECTION

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SECTION 32 91 13 - SOIL PREPARATION

PART 1 GENERAL

1.01 SUMMARY

- A. Furnish all labor, materials, equipment, facilities, transportation and services to complete all planting area soil preparation and related work as shown on the Drawings and/or specified herein.
- B. The general extent of the preparation of planting areas is shown on the drawings and includes, but is not necessarily limited to the following:
 - 1. Planting soil.
 - 2. Soil for bioretention areas.
 - 3. Organic soil amendments.

1.02 RELATED WORK

- A. Section 01 56 39 – Temporary Tree and Plant Protection
- B. Section 02 41 13 – Selective Site Demolition
- C. Section 02 41 19 – Landscape Selective Demolition
- D. Section 31 00 00 – Site Clearing, for site topsoil stripping and stockpiling
- E. Section 31 23 33 – Trenching, Backfilling, and Compacting, for backfill at utility trenches
- F. Section 32 84 00 – Irrigation
- G. Section 32 92 00 – Turf and Grasses
- H. Section 32 93 00 – Plants
- I. Section 32 96 00 – Transplanting
- J. Section 33 47 27 – Bioirretention

1.03 DEFINITIONS

- A. AAPFCO: Association of American Plant Food Control Officials.
- B. Amendment: Organic materials added to imported or native soil to produce planting soil mix suitable to plant growth. Amendments include general soil additives, fertilizers, biological and pH amendments.
- C. Backfill: For the purposes of planting, excavated or stockpiled native soil mixed with top soil and/or approved soil amendments. Backfill soil shall be clean and free of large stones and roots, plants, sod, clods, clay lumps, pockets of coarse sand, and of suitable moisture content and granular texture for placing around tree rootball. For non-planting related purposes, see

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Section 31 23 33 – Trenching, Backfilling and Compacting for backfill requirements at utility trenches.

- D. Biological Amendment: Mycorrhizal additives, compost tea, or other products intended to modify the soil biology.
- E. CCQC: California Compost Quality Council, verifies that compost producers are in compliance with state compost regulations and standards. www.crra.com
- F. CEC: Cation exchange capacity.
- G. Compacted Soil: Soil with density greater than the threshold for root limiting.
- H. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.
- I. Drainage: The rate at which soil water moves through the soil transitioning the soil from saturated condition to field capacity, in inches per hour, or expressed as hydraulic conductivity.
- J. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.
- K. Existing Soil or Native soil: Mineral soil existing at the locations of proposed planting after the majority of construction within and around the planting site is completed and just prior to the start of work to prepare the planting area for soil modification and planting.
- L. Fertilizer: Amendment used to adjust soil nutrient composition and balance.
- M. Fine Grading: The final grading of soil to achieve exact spot elevations and positive drainage.
- N. Imported Soil: Soil that is transported to Project site for use.
- O. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.
- P. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.
- Q. Minor Disturbance: Minor grading as part of agricultural work that only adjusts the A soil horizon, minor surface compaction in the top 6 inches of soil, applications of fertilizers.
- R. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.
- S. OMRI: Organic Materials Research Institute, assures product compliance with regulations of the National Organic Program for organically approved products. www.omri.org
- T. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

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- U. Planting Soil: Existing on-site soil, topsoil, imported soil, or manufactured soil that has been modified as specified with soil amendments and/or fertilizers to produce a soil mixture best for plant growth.
- V. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
- W. Scarify: Loosening and roughening the surface of soil and subsoil prior to planting.
- X. Soil Horizons: As defined in the USDA National Soil Survey Handbook.
- Y. SSSA: Soil Science Society of America.
- Z. STA: US Composting Council STA Program, assures that compost producers have regularly tested compost for chemical, physical and biological properties. www.compostingcouncil.org
- AA. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- BB. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- CC. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil;" in disturbed areas such as urban environments, the surface soil can be subsoil.
- DD. Topsoil: naturally produced and harvested soil from the A horizon or upper layers of the soil.
- EE. USCC: U.S. Composting Council.

1.04 REFERENCES

- A. Applicable ASTM Specifications.
- B. TMECC (Test Methods for the Examination of Composting and Compost), from USCC (US Composting Council)
- C. Organic Materials Review Institute (OMRI), www.omri.org

1.05 SUBMITTALS, TESTS AND INSPECTIONS

- A. Prior to commencing soil preparation operations, request a review by the Owner's Representative to verify specified limits and grades of work completed. If additional inspections or observations by the Owner's Representative are required as a result of Contractor's non-compliance with these Specifications, Contractor shall pay for such additional inspections or observations at no increase in contract sum.
- B. Product Data: For each type of product.
 - 1. Include recommendations for application and use.
 - 2. Include test data substantiating that products comply with requirements.
 - 3. Include sieve analyses for aggregate materials.

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4. Material Certificates: For each type of imported soil, soil amendment and organic fertilizer before delivery to the site, according to the following:
 - a. Manufacturer's qualified testing agency's certified analysis of standard products.
 - b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
- C. Soil Fertility Analysis:
1. For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; salinity, nitrate, ammonium, phosphate, potassium, calcium, magnesium, boron, sodium absorption ratio (SAR); deleterious material; pH; agricultural suitability, infiltration rate, and mineral and plant-nutrient content of the soil
 2. The Contractor shall obtain soil fertility tests for all of the following:
 - a. Existing in-place soils, native surface topsoil.
 - b. Imported soil.
 - c. Organic soil amendments.
 3. The tests shall be performed at Contractor's expense. The results of these tests shall be submitted to the Owner's Representative for review by the Landscape Architect to decide whether to accept the soil.
 4. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed, as listed but not limited to:
 - a. For soil testing: Wallace Laboratory, Inc, El Segundo (310) 615-0116
 - b. For compost testing: Soil Control Lab, Watsonville (831) 761-7273
 5. Laboratory soil testing report shall be no older than 6 months from the date of Landscape Architect's review, and shall represent the product delivered to the project site.
 6. Laboratory compost testing report shall be no older than 3 months from the date of Landscape Architect's review, and shall represent the product delivered to the project site.
 7. Soil testing laboratory to provide recommendations for organic soil amendments, including the use of Greenwaste compost. Request that lab state the amount of compost that is required to bring soil organic matter content to a minimum of 5%.
 - a. Recommendations for synthetic amendments and fertilizers will be rejected.
 8. Lab shall report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, lab shall provide additional recommendations for corrective action.
- D. Soil sampling requirements:
1. General: Extract soil samples according to requirements in this article.
 2. Sample Collection and Labeling: Contractor to collect and label soil samples per directions described by soil testing laboratory.
 - a. Number and Location of Samples: Six representative soil samples from varied locations as shown on Drawings for each soil to be used or amended for planting.

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- b. Procedures and Depth of Samples: Per soil testing laboratory standards.
 - c. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.
- E. Certifications:
 - 1. Certifications must be provided as a submittal for soil amendment and mulch from an approved testing agency.
 - 2. Organic Soil Amendments: Organic Materials Review Institute (OMRI) listed soil amendments only. Submit Manufacturer's certificate.
- F. Testing:
 - 1. All imported materials, including soil, mulch, and amendments, must certify that they do not exceed lead levels greater than or equal to 80 ppm.
- G. Samples:
 - 1. The Contractor shall submit to the Owner's Representative at least three weeks prior to installation Samples of materials for approval. For standard products, also submit the manufacturer's certified analysis. For other materials, submit an analysis by a recognized laboratory made in accordance with the current methods established by the Association of Official Agricultural Chemists. Each Sample shall be typical of the material to be furnished; provide an accurate representation of color, texture, and organic makeup
 - 2. Samples to be submitted to Owner's Representative for approval:
 - a. One-quart sample of compost in zip-lock bag with product name, composition of materials by percentage of weight and source, and manufacturer contact info marked on bag.
- H. Contractor shall submit to the Owner's Representative written certification stating quantity, type, composition, weight and origin of all amendments and chemicals delivered to the site for soil preparation work.
- I. Verification of Material: The Contractor shall, upon demand, produce records to verify the ordering and delivery of specified quantities and types of material for this job.

1.06 DELIVERY, STORAGE, STOCKPILING, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.
- B. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants or under tree canopies.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk organic soil amendments with appropriate certificates.
- C. Soil and Compost:

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1. Compost shall be delivered to site at least three weeks prior to commencement of work, and sample submitted to Owner's Representative for Landscape Architect's approval.
2. Compost that is warm to the touch will be rejected as not fully mature and not suitable for application.
3. Compost that is to be stockpiled for longer than two weeks shall not be placed in mounds higher than 6 feet.
4. Soil and compost that is stockpiled shall be covered at least two weeks prior to installation to prevent excess moisture from saturating the soil stockpile. Check moisture content at least two days prior to soil installation.
5. Soil materials shall not be handled or hauled, placed, or compacted when it is wet, as during or after rain, nor when frozen.

1.07 QUALITY ASSURANCE

- A. All local, municipal and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything in these specifications shall not be constructed as conflicting with any such rules and regulations, or the requirements of the same. However, when these specifications and drawings call for or describe materials, workmanship or construction of a better quality, higher standard, or larger size than is required by such rules and regulations, the provisions of these specifications and drawings shall take precedence.
- B. Contractor shall exercise caution and provide necessary safeguards to prevent injury to, or defacement of, existing site improvements, including planting and underground utilities. Contractor shall repair or replace, at no increase in contract sum, property damaged as a result of his work.
- C. Before commencing site work, locate underground utilities to preclude any possible damage. Do not use heavy equipment which may cause damage to existing facilities. Use hand excavation as required to minimize possibility of damage to underground utilities.
- D. Protect existing utilities, paving, irrigation and other facilities from damage caused by landscape operations.
- E. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by the Owner unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated.
 1. Notify Owner's Representative no fewer than five business days in advance of proposed interruption of each service or utility.
 2. Do not proceed with interruption of services or utilities without Owner's written permission.
- F. Equip internal combustion motors and compressors with mufflers. Do not leave such equipment running under trees.
- G. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of planting areas and construction contiguous by field measurements before proceeding with soil work.

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- H. Areas to be planted shall be graded by Contractor to finish grades indicated on Drawings. Contractor shall grade landscape areas in such a manner as to direct drainage away from buildings and walkways. Contractor shall grade all landscape areas as not to allow standing water. Minimum percentage of slope to all landscape areas shall be two percent (2%). Contractor shall notify Owner's Representative prior to start of construction if he anticipates any drainage problems.
- I. Before Proceeding With The Work: Contractor shall check rough-graded areas and verify all dimensions and quantities. Contractor shall immediately inform the Owner's Representative of any discrepancy between the Drawings and Specifications and actual conditions. Contractor shall perform no work in any area where there is such a discrepancy until approval has been given by the Owner's Representative.
- J. Weather Limitations: Apply soil amendments during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Planting Soils:
 - 1. All planting areas shall provide a minimum depth of twelve inches of uncompacted soil except where tree roots or bedrock limit the depth.
 - 2. Native Topsoil
 - a. Shall be on-site existing topsoil after all rocks over two inches and all foreign debris have been removed. Native topsoil shall be free of any substance harmful to plant growth and shall have organic material and soil characteristics capable of sustaining healthy plant life. Heavy clay soil shall not be considered for use as topsoil. Suitable native topsoil shall be stockpiled for re-use where required to replace existing topsoil.
 - b. Topsoil shall be tested in accordance with Section "Soil Fertility Testing".
 - 3. Import Amended Topsoil
 - a. Imported Amended Topsoil or Manufactured Topsoil shall be:
 - 1) General Landscape Amended Topsoil – "General Landscape" by American Soil & Stone, www.americansoil.com or approved equal.
 - 4. All imported topsoil shall have an agricultural suitability test, dated within thirty (30) days of delivery and indicating compliance with these specifications, by a qualified soils laboratory prior to delivery to the job site.
 - 5. Fertility: Follow all recommendations of the Testing Lab Report based on the Soil Fertility Test results.
- B. Blended Soil for Bioretention Areas: Refer to section 33 47 27 – Bioretention.
- C. Organic Soil Amendments and Fertilizers:
 - 1. Organic Soil Amendments shall be first quality organic agricultural products approved for use in organic crop production by OMRI (Organic Materials Review Institute), see

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www.OMRI.org. Soil amendments that are not approved or are restricted for use shall be applied only after review and written approval by the Owner's Representative. The Owner's Representative shall determine appropriate amendments for the species of plants to be established following review of the submittal of the soil fertility test results and recommendations for amendment.

- a. Synthetic fertilizers and amendments are prohibited on this Project.
2. Organic Compost: Compost shall be a well decomposed, fully stabilized, weed free organic matter source. The product shall be certified through the US Composting Council's (USCC) Seal of Testing Assurance Program (STA) Program (a compost testing and information disclosure program). It shall be derived from agricultural or food waste or yard trimmings. The product shall contain no substances toxic to plants, will possess no objectionable odors and shall not resemble the feedstock (the original materials from which it was derived).
 - a. The submitted lab report shall verify:
 - 1) Feedstock Materials shall be specified and include one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues.
 - 2) Organic Matter Content: 50% - 65% by dry wt. preferred, 35-70% acceptable
 - 3) Carbon and Nitrogen Ratio: C:N < 25:1 plus at least one measure of stability and at least one measure of toxicity.
 - 4) Maturity/Stability: shall have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120F) upon delivery or rewetting is not acceptable. In addition any one of the following is required to indicate stability
 - (a) < 1.3 O₂ / unit TS / hr
 - (b) < 1.5 O₂ / unit BVS / hr
 - (c) < 8 C / unit VS / day
 - (d) < 20 Temp. rise (oC)
 - (e) > 5 Index value
 - 5) Toxicity: any one of the following measures is sufficient to indicate non-toxicity.
 - (a) < 3
 - (b) < 500 ppm, dry basis
 - (c) > 80 % of control
 - (d) > 80% of control
 - 6) Nutrient Content: provide analysis detailing nutrient content including N-P-K, Ca, Na, Mg, S, and B.
 - (a) Total Nitrogen content 0.9% or above preferred.
 - (b) Boron: Total shall be <80 ppm; Soluble shall be <2.5 ppm
 - 7) Salinity: Must be reported; may vary but < 4.0 mmhos/cm preferred. Soil should also be tested: <2.5 mmhos/cm is preferred for soil/compost blend but may vary with plant species.
 - 8) pH: pH shall be between 6.5 and 8. May vary with plant species.
 - 9) Particle size: 95% passing a 1/2" screen.
 - 10) Bulk density: shall be between 500 and 1100 dry lbs/cubic yard

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- 11) Moisture Content shall be between 35% - 55% of dry solids.
- 12) Inerts: compost shall be relatively free of inert ingredients, including glass, plastic and paper, < 0.1 % by weight or volume.
- 13) Weed seed/pathogen destruction: provide proof of process to further reduce pathogens (PFRP). For example, turned windrows must reach min. 55C for 15 days with at least 5 turnings during that period.
- 14) Select Pathogens: Salmonella <3 MPN/4grams of TS, or Coliform Bacteria <10000 MPN/gram.
- 15) Trace Contaminants Metals (Lead, Mercury, Etc.) Product must meet US EPA, 40 CFR 503 regulations.
- b. Compost shall contain biological activity as follows (per gram of compost):
 - 1) 15 to 30 or more µg active bacteria
 - 2) 150 µg to 300 or more µg total bacteria
 - 3) 2 to 10 µg or more active fungi
 - 4) 150 to 500 or more (fungal compost) µg total fungal biomass
 - 5) 50,000 or more protozoa
 - 6) 25,000 or more flagellates
 - 7) 25,000 or more amoebae
 - 8) 50 - 100 ciliates
 - 9) 20-100 beneficial nematodes
 - 10) No root-feeding nematodes
3. Mycorrhizal Fungi: Dry, granular, water soluble inoculant containing at least 5300 spores per pound of vesicular-arbuscular mycorrhizal fungi and 95 million spores per pound of ectomycorrhizal fungi, and a maximum of 5.5 percent inert material.
4. Additional amendments and/or fertilizers as required in the soils report.
 - a. Additional amendments and fertilizers that are approved for use by the Organics Materials Research Institute (OMRI) for use in crop production may be approved for use by the Landscape Architect. See www.omri.org. Fertilizers that are not approved or are restricted for use by OMRI shall be applied only after review and written approval by the Landscape Architect.
5. Soil Amendment Application Rates: Rates shown are for bidding purposes only. The Owner's Representative/Landscape Architect shall approve amendment application rates that are appropriate for the plant species to be established after review of the soil test results and amendment recommendations. For estimating purposes, assume the listed rates of application:
 - a. Azomite - 6 pounds per 1000 square feet
 - b. Compost - 1 cubic yard/ 1000 square feet
 - c. Compost Tea (AACT) – 30 Gallons per acre (spray at less than 100 psi)
 - d. Humic Acid – TurfPro: Apply 6-8 ounces of Turf and Garden Pro product per 1000 square feet of lawn
 - e. VermaPlex Liquid Inoculant – 5 Gallons per acre
 - f. Solu-PLKS – 2 Gallons per acre (may be added to AACT)
 - g. Worm castings – ½ Cubic Yard per 2500 square feet
- D. Pesticides: No synthetic or chemical pesticides will be allowed.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive soil and mulch for compliance with requirements and conditions affecting installation and performance.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area. If foreign or deleterious material is found remove the soil and contamination as directed by Owner's Representative and replace with new planting soil.
 - 2. Do not mix or place soils and soil amendments in wet, rainy, or muddy conditions.
 - 3. Suspend soil spreading and grading operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PROTECTION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by soil and mulch placement operations.
- B. Install erosion-control measures as needed to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkway.

3.03 CLEARING

- A. In all areas to be planted, remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off the property.
- B. In all planting areas, remove concrete and plaster debris larger than 1 inch in any dimension.
- C. In all areas to be planted, remove any noxious or invasive weeds and dispose offsite.

3.04 PREPARATION OF SUBSOIL

- A. Prepare subsoil to eliminate uneven areas. Make changes in grade gradual, blend slopes smoothly into level areas.
- B. Remove contaminated subsoil, foreign materials, weeds and undesirable plants and roots.
- C. Subgrade Scarification: All areas to be planted shall be cross-ripped and scarified to a minimum depth of 8" prior to planting or as specified on the Drawings. Break down large clods, remove rocks over two inches in any dimension, gravel, and miscellaneous debris. Any areas which, subsequent to initial ripping, become recompacted as a result of having been subjected to vehicular traffic shall be re-ripped before placement of topsoil.
- D. Dig pits and beds larger than plant root system as shown on Drawings.

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3.05 SOIL PREPARATION

- A. Soil Moisture Content: Do not work soil when moisture content is so great that excessive compaction will occur, or when the soil is so dry that clods will not break readily or dust will form in the air. Apply water as required to prevent the formation of an airborne dust nuisance and to provide ideal soil moisture content for tilling.
- B. Planting areas where soil must be loosened to alleviate compaction:
 - 1. Planting area is to be prepared with as little tilling as possible.
 - 2. Scarify or till soil to depth needed to achieve a total depth of 12 inches of uncompacted soil after organic amendments are added.
 - 3. Do not scarify or till within drip line of existing trees to be retained.
 - 4. If planting area soil will be loosened prior to planting, incorporate organic soil amendments into the top six inches of soil while soil is being loosened.
- C. Planting areas that will receive imported soil:
 - 1. Before adding imported topsoil, scarify subsoils to a depth of six inches.
 - 2. Do not scarify or till within drip line of existing trees to be retained.
 - 3. Place topsoil during dry weather and on dry subgrade.
 - 4. Place first lift of three inches of imported topsoil on scarified surface and till into subsoil.
 - 5. Place second lift of three inches or more of imported topsoil on surface to achieve a minimum depth of twelve inches of friable soil.
 - 6. Grade planting beds smooth, eliminate rough, low or soft areas, and to ensure positive drainage.
 - 7. Top of tamped soil adjacent to hardscape to be 4" below curbs and paving to accommodate mulch.
- D. Verify that all planting beds shall have a minimum depth of twelve inches of uncompacted soil except where tree roots or bedrock limit the depth. Soil compaction shall be measured using a soil cone penetrometer.
- E. Incorporate soil amendments as specified, cultivate top six inches (6-inches) of soil in all areas, and remove all sticks, stones over one inch (1-inch) in any dimension, roots, weeds and other foreign material. Topsoil shall be placed as needed to bring existing grades to finish grades shown in the Drawings, and all areas shall be hand graded and smoothed.
- F. Placement of blended soil – Place per Drawings.

3.06 ORGANIC SOIL AMENDMENT APPLICATION

- A. Apply organic soil amendments directly to surface of planting area after removing weeds and tilling soil. Cover with layer of compost. Till soil amendments into soil.

3.07 AMENDMENT REQUIREMENTS FOR PLANTED AREAS

- A. Shaping and finish grading to be finished and approved by Landscape Architect prior to planting area preparation.

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B. Amendment Application:

1. The Contractor shall obtain horticultural soils reports for the existing site soil planted area and for the imported sandy loam or loamy sand topsoil from Soil testing laboratory. The reports shall indicate the required soil preparation, and amendments materials and quantities necessary to insure establishment of healthy and vigorous turf, groundcover, shrubs, and trees.

3.08 FINISH GRADING

- A. After completion of pavements and structures, areas to be planted shall be graded and shaped by blading, dragging, and other means. Finished surfaces shall be uniform and smooth and shall conform to slopes and finish grades indicated on the Drawings after soil preparation, settlement, and planting have occurred. Minor adjustments to finish grades shall be made at the direction of the Owner's Representative if required.
- B. Finished grades shall provide for surface drainage of planting areas. Contractor shall correct drainage condition which may be detrimental to the growth of plants or which result in retention of water in tree pits.
- C. Finish grades of soil in planting areas shall be four inches below adjacent pavement or tops of curbs after settlement to allow for mulch placement.
- D. Tops and toes of all slopes shall be rounded to produce a smooth, continuous, and natural-appearing transition between slopes and relatively level areas.
- E. Finish grading shall direct water away from all structures and walks.
- F. Contractor shall obtain approval by Owner's Representative for finish grades before any seeding or planting begins.

3.09 CLEANUP AND PROTECTION

- A. During soil installation, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Disposal: Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash and debris and dispose of them off Owner's property.

END OF SECTION

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SECTION 32 92 00 – TURF AND GRASSES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Preparation of soil, installation, fertilization and maintenance of the following:
 - a. Sodded turf.
 - b. Planted grasses.
 - c. Seeded grasses in GrassCrete paving as part of Alternate Bid.
- B. Related Sections:
 - 1. Section 01 23 00 – Alternates, for seeded grass.
 - 2. Section 03 30 00 – Cast-in-Place Concrete, for flush concrete curb header.
 - 3. Section 32 01 90 – Landscape Maintenance, for onset and duration of maintenance period, and for general maintenance requirements.
 - 4. Section 32 14 43 – Porous Unit Paving, for GrassCrete paving as part of Alternate Bid.
 - 5. Section 32 93 00 – Plants, for trees, shrubs, ground covers, and other plants.
 - 6. Section 32 84 00 – Irrigation, for irrigation systems.
 - 7. Section 32 91 13 – Soil Preparation, for soil and organic amendments.

1.03 DEFINITIONS

- A. AOSA: Association of Seed Analysts.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- E. Planting Soil: Existing on-site soil, imported soil, or manufactured soil that has been modified with soil amendments and/or fertilizers to produce a soil mixture best for plant growth. See Section 32 91 13 - Soil Preparation and drawing designations for planting soils.

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F. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

G. TPI: Turfgrass Producers International.

1.04 REFERENCES

A. "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding."

B. AOSA's "Rules for Testing Seeds."

1.05 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site. Representatives of each entity directly concerned with turf planting are required to attend.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.

B. For Alternate Bid:

1. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
2. Certification of each seed mixture for sod. Include identification of source and name and telephone number of supplier.

C. Product Certificates: For organic fertilizers, from manufacturer.

D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to the Project.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf and grass establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landscape Network or the American Nursery and Landscape Association.
2. Experience: Three years' experience in turf installation.
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

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4. Pesticide Applicator: State licensed, commercial.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.
- B. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.
- C. Bulk Materials:
 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways. See Sedimentation and Erosion Control Plan.
 3. Accompany each delivery of bulk materials with appropriate certificates.

1.10 FIELD CONDITIONS

- A. Planting Restrictions: Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.11 WARRANTY

- A. Special Warranty: Repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period. Provide replacements and repairs at no additional cost and as acceptable to Owner.
 1. Failures include, but are not limited to, death and unsatisfactory growth of plants.
 2. Warranty Periods: From date of Substantial Completion: 12 months.
 3. Include the following remedial actions as a minimum:
 - a. Immediately remove dead grass and replace to Owner's satisfaction.
 - b. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 PRODUCTS

2.01 TURFGRASS SOD

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- A. Turfgrass Species: Proprietary sod mix. Subject to compliance with requirements, provide sod mix as indicated on Drawings.
- B. Turfgrass Sod: Approved, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted and capable of vigorous growth and development when planted.
- C. Install sodded turf after flush concrete headers are in place.
- D. Install sodded grass adjacent to existing turf. Cut clean edges in existing turf and install new turf seamlessly with existing.

2.02 SEED, AS PART OF ALTERNATE BID

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species:
 - 1. High Quality, State certified seed of grass species.
 - 2. Refer to Drawings for species of seed mix.
- C. Install seeded grasses in GrassCrete paving. Refer to Drawings for locations.

2.03 FERTILIZERS

- A. Refer to Section 32 91 13 "Soil Preparation" for acceptable fertilizers. Fertilizers prohibited in the Generic Materials List by the Organic materials Review Institute (OMRI) are prohibited in the project.

2.04 PESTICIDES

- A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective): Effective for controlling weed growth that has already germinated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

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1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 3. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination and replace with new planting soil.

3.02 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
1. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways. Refer to Sedimentation and Erosion Control Plan.

3.03 TURF AREA PREPARATION

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 32 91 13 "Soil Preparation."
- B. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade.
1. Refer to Drawings for depth of soil and amendments.
 2. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- D. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.04 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

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1. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.
- D. Install newly sodded turf adjacent to existing in a manner to seamlessly blend with existing turf. Cleanly cut and remove existing turf as needed for new sod installation.
- E. Repair existing sod planting as needed and to the satisfaction of Landscape Architect.

3.05 SEEDING, AS PART OF ALTERNATE BID

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.
 1. Evenly distribute seed by sowing equal quantities in two perpendicular directions.
 2. Do not use wet seed or seed that is moldy or otherwise damaged.
- B. Protect seeded areas from hot, dry weather or drying winds by applying planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 0.5 inch and roll surface smooth.
- C. Sow grass in GrassCrete as close to the surface as possible to allow for settlement and topping off of soil.

3.06 TURF MAINTENANCE

- A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, re-grade, and replant bare or eroded areas to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 1. Fill in as necessary soil subsidence that may occur because of settling or other processes.
 2. Replace materials and turf damaged or lost in areas of subsidence.
 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices to minimize the use of pesticides.
- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of mulch. Lay out temporary watering system to avoid walking over mud or newly planted areas.
 2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowing. Do not delay mowing until grass blades bend

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over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowing to maintain the grass height of 3 inches.

- D. Turf Post-fertilization: Apply organic fertilizer after initial mowing and when grass is dry.
 - 1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.07 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Landscape Architect:
 - 1. At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.08 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Post-Emergent Herbicides (Selective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.09 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.
- C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

3.10 MAINTENANCE

- A. Turf Maintenance: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article.
- B. Refer to Section 32 01 90 – Landscape Maintenance for duration of maintenance period.

END OF SECTION

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SECTION 32 93 00 - PLANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. New trees, shrubs, perennials, vines and ground covers, and other plants.
- B. Wood header for sodded turf, GraniteCrete paving, and unit pavers.
- C. Mulches.
- D. Boulders.
- E. Planting accessories, including tree stabilization.
- F. Maintenance.

1.02 RELATED REQUIREMENTS

- A. Section 01 56 39 – Temporary Tree and Plant Protection, for protection of existing trees, and for selective pruning.
- B. Section 02 41 19 – Landscape Selective Demolition, for salvage of site boulders.
- C. Section 31 22 00 – Earthwork and Grading, for establishment of finish grade.
- D. Section 32 01 90 – Landscape Maintenance.
- E. Section 32 14 43 – Porous Unit Paving, for Core Gravel paving fill.
- F. Section 32 84 00 – Irrigation, for automatic irrigation of all new planting.
- G. Section 32 91 13 – Soil Preparation, for types of soil and soil amendments.
- H. Section 32 92 00 – Turf and Grasses.
- I. Section 32 96 00 – Transplanting.
- J. Section 33 47 27 – Bioretention.

1.03 DEFINITIONS

- A. Backfill: For the purposes of planting, excavated or stockpiled native soil mixed with top soil and/or approved soil amendments. Backfill soil shall be clean and free of large stones and roots, plants, sod, clods, clay lumps, pockets of coarse sand, and of suitable moisture content and granular texture for placing around tree rootball. For non-planting related purposes, see Section 31 23 33 – Trenching, Backfilling and Compacting for backfill requirements at utility trenches.

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- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
- D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.
- E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
- G. Finish Grade: Elevation of finished surface of planting soil.
- H. Mulch: Top dressing for protection of soil in planting areas. Refer to Drawings for type in various locations, and depth.
- I. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.
- J. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- K. Plant; Plants; Plant Material: Vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation, as and described in ANSI Z60.1.
- L. Planting Area: Areas to be planted.
- M. Planting Soil: Existing on-site soil, topsoil, imported soil, or manufactured soil that has been modified with soil amendments and/or fertilizers to produce a soil mixture best for plant growth. See Section 32 91 13 "Soil Preparation."
- N. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- O. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

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- P. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- Q. Topsoil: naturally produced and harvested soil from the A horizon or upper layers.
- R. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.04 REFERENCE STANDARDS

- A. ANSI/AHIA Z60.1 - American National Standard for Nursery Stock 2014.
- B. ANSI A300 Part 1 - American National Standard for Tree Care Operations -- Tree, Shrub and Other Woody Plant Maintenance -- Standard Practices 2017.
- C. ASTM D448 – American National Standard Classification for sizes of aggregate.
- D. Cal IPC: California Invasive Plant Council standards for approved non-invasive plant species.

1.05 COORDINATION

- A. Plant trees, shrubs, and other plants after finish grades are established unless otherwise indicated.

1.06 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site. Representatives of each entity directly concerned with planting are required to attend.

1.07 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
 - 2. Plant Photographs: Include color photographs in high-resolution digital format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.
 - 3. Stakes: Manufacturer's current cut sheets and specifications
 - 4. Mulch: Manufacturer's current cut sheets and specifications
 - 5. Anti-desiccant: Manufacturer's current cut sheets and specifications
 - 6. Fertilizers: Refer to Section 32 91 13 "Soil Preparation."

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- B. List of all nurseries from which plants will be procured.
1. Endeavor to procure plants from nurseries with a record of no use of systemic insecticides, such as neonicotinoids. Preferred nurseries include, but are not limited to:
 - a. Devil Mountain Nursery (925) 829-6006
 - b. Native Sons Nursery (805) 481-5996
 - c. Suncrest Nurseries (805) 683-1561
 - d. Cal Color Growers (408) 778-0835
 - e. CedarGlen Floral (503) 658-3370
 - f. Central Coast Wilds (831) 459-0655
 - g. Crimson Sage Nursery (503) 627-3065
 - h. InterMountain Nursery (559) 855-3113
 - i. Mountain Valley Growers (559) 338-2775
- C. Samples for Verification: For each of the following:
1. Trees: Deliver to site trees selected and tagged by Landscape Architect in nursery. Trees will be documented by photograph and description.
 2. Boulders: Deliver to site boulders selected and tagged by Landscape Architect in stone supply yard. Boulders will be documented by photograph and description.
 - a. Alternatively, provide photographic and descriptive information for boulders sourced in a stone yard. Include photos of at least four (4) boulders tagged at supply yard, clearly showing form, texture, typical color range, finish and size. Include yard stick or measuring tape in photo for indication of size.
 3. Mulch: 1-pint volume of each mulch type; in sealed plastic bags, labeled with composition of materials by percentage of weight, and source of mulch. Each Sample shall be typical of the lot of material to be furnished. Provide an accurate representation of color, texture, and organic makeup.

1.08 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
1. Manufacturer's certified analysis of standard products.
 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to the Project.
1. Certificate: Certify fertilizer and herbicide mixture approval by OMRI and California Department of Pesticide Regulation.
 2. Systemic pesticides are prohibited on this Project.

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- D. Certificate: Submit certificate for plants free of disease or hazardous insects; certified by federal department of agriculture; free of disease or hazardous insects.
- E. Maintenance Data: Include cutting and trimming method; types, application frequency, and recommended coverage of fertilizer. Synthetic fertilizers are prohibited on this Project.
- F. Submit list of plant life sources.
- G. Maintenance Contract.
- H. Sample Warranty: For special warranty.

1.09 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.10 QUALITY ASSURANCE

- A. Nursery Qualifications: Company specializing in growing and cultivating the plants with three years documented experience.
- B. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
 - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 - 2. Experience: Three years' experience in landscape installation similar to the Project.
 - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 4. Pesticide Applicator: State licensed, commercial.
- C. Tree Pruner Qualifications: Company specializing in pruning trees with proof of independent Arborist Certification.
 - 1. Arborist to submit all communication to the Construction Manager.
- D. Tree Pruning: Conform to ANSI A300 Part 1.
- E. Maintenance Services: Performed by installer.
- F. Non-native, Invasive Plant Species: Do not introduce, grow, or cultivate plant species that are non-native to the ecosystem of the project site, and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.
 - 1. Conform to laws regulating non-native and invasive plant species in the State of California.
- G. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- H. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

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1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- I. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
1. Notify Landscape Architect of sources of planting materials three days in advance of delivery to site.
- J. Set all boulders in place for field approval by Landscape Architect prior to final and permanent setting or attachment.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
1. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways. See Sedimentation and Erosion Control Plan.
 3. Accompany each delivery of bulk materials with appropriate certificates.
- C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- D. Handle planting stock by root ball, not by stems or trunks.
- E. Apply anti-desiccant to trees and shrubs before wrapping, using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

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1. If deciduous trees or shrubs are moved in full leaf, spray with anti-desiccant at nursery before moving and again two weeks after planting.
- F. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.
- G. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
 1. Do not remove container-grown stock from containers before time of planting.
 2. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray.
 3. Water as often as necessary to maintain root systems in a moist, but not overly wet condition, and as appropriate for each specie's water needs.

1.12 FIELD CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Planting Restrictions: Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
- C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
 1. Do not install plants when ambient temperatures may drop below 35 degrees F or rise above 90 degrees F.
 2. Do not install plants when wind velocity exceeds 30 mph.
- D. Landscape architect shall approve placement and final location of landscape boulders in the field and reserves the right of field adjustment.

1.13 WARRANTY

- A. See Section 01 78 36 - Warranties, for additional warranty requirements.
- B. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth due to defects resulting from abuse, lack of adequate maintenance, or neglect.
 - b. Structural failures including plantings falling or blowing over.
 - c. Faulty performance of tree stabilization.
 2. Warranty Periods: From date of Substantial Completion.

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- a. Trees, Shrubs and Vines: 12 months.
 - b. Ground Covers and Perennials: 12 months.
 - c. Turf and Grasses: Refer to Section 32 92 00.
3. Include the following remedial actions as a minimum:
 - a. Immediately remove dead plants and replace.
 - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
 - d. Provide extended warranty for period equal to original warranty period, for all replaced plant material. Commencement of new warranty period is on date of replacement.

1.14 MAINTENANCE

- A. See Section 32 01 90 "Landscape Maintenance."
- B. Provide a separate maintenance contract for specified maintenance service.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Comply with OMRI regulatory requirements for fertilizer composition.
- B. Provide certificate of compliance from California Department of Pesticide Regulation indicating herbicide mixture.
- C. Comply with Cal IPC for approved plant species.

2.02 PLANTS

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
 1. Unacceptable Characteristics: Trees with damaged, crooked, or multiple leaders on standard tree forms; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; stem girdling roots.
 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Prioritize sourcing plants from nurseries that do not use neonicotinoids or other systemic insecticides.

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- C. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.
- D. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- E. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable.
- F. If consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.
- G. Species and size identified in plant schedule, grown in climatic conditions similar to those in locality of the work.

2.03 PLANT QUALITY ABOVE THE SOIL LINE

- A. Plants shall be healthy with the color, shape, size and distribution of trunk, stems, branches, buds and leaves normal to the plant type specified.

2.04 PLANT QUALITY AT OR BELOW THE SOIL LINE

- A. Plant roots shall be normal to the plant type specified. Root observations shall take place without impacting the plant health.
 - 1. At time of observations and delivery, the roots shall be moist throughout. Roots shall not show signs of excess soil moisture conditions as indicated by stunted, discolored, distorted or dead roots.

2.05 UNAVAILABLE MATERIAL

- A. If proof is submitted that a specified plant is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract price. Substantiate such proof in writing no later than 30 days after award of contract.
- B. Special conditions: The above provision shall not relieve the Contractor of the responsibility to obtain specific materials in advance if special growing conditions or other arrangements must be made in order to supply specified material.

2.06 SOIL MATERIALS AND AMENDMENTS

- A. As specified in Section 32 91 13 "Soil Preparation."
- B. Refer to Drawings for depth of amended soil in each planting area.

2.07 MULCH

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- A. Mulch shall be free of deleterious materials, free of growth or germination inhibiting ingredients, and suitable as a top dressing of trees and shrubs. Mulch shall be locally produced.
- B. Compost Mulch:
 - 1. In all new planting areas.
 - 2. Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch sieve; soluble-salt content of 2 to 5 dS/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 3. Organic Matter Content: 50 to 60 percent of dry weight.
 - 4. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
 - 5. Refer to Section 31 9113 "Soil Preparation" for other compost characteristics.
 - 6. Depth: 3 inches minimum.
- C. Mineral Mulch:
 - 1. In all rain gardens and bioretention facilities.
 - 2. Depth: 3 inch min.
 - 3. Dissipation cobbles: clean. Refer to Drawings for type and installation.
 - 4. Dissipation pebbles: clean, 4" deep. Refer to Drawings for type.
- D. Bark Mulch:
 - 1. In all tree protection zones and specific root protection areas, refer to Drawings.
 - 2. One of the following, or approved, locally available equal:
 - a. Mixed and Aged, screened 3" minus mulch from Greenwaste Recycle Yard, Richmond, CA.
 - b. Arbor Mulch from Grover Landscape, Modesto, CA
 - 3. Color: Natural, without dyes or other additives.
 - 4. Redwood bark mulch or shredded bark mulch (Gorilla hair) is not acceptable.

2.08 PESTICIDES AND HERBICIDES

- A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Do not use neonicotinoids or other systemic insecticides.
- C. Synthetic or chemical pesticides are not allowed on the Project.
- D. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- E. Post-Emergent Herbicide (Selective): Effective for controlling weed growth that has already germinated.

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2.09 WOOD HEADER

- A. Species: Western Red Cedar, Redwood, or other approved species
 - 1. Edging: Refer to Drawings for size.
 - 2. Stakes: 1-by-2-inch nominal, refer to Drawings for length.
 - 3. Galvanized steel nails for anchoring

2.10 ACCESSORIES

- A. Wrapping Materials: Burlap, Non-synthetic, biodegradable.
- B. Root-Ball Stabilization Materials:
 - 1. Upright Stakes: Rough-sawn, sound, softwood, free of knots, holes, cross grain, and other defects, as indicated on Drawings; stakes pointed at one end.
 - 2. Wood Screws: ASME B18.6.1.
 - 3. Ties: As indicated on Drawings. Wire ties will be rejected.
- C. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.
- D. Wrapping: Waterproof fabric.
- E. Drainage Gravel: Washed crushed stone or gravel complying with ASTM D 448 for Size No. 8.
- F. Anti-desiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
- G. Boulders: See Drawings for type, source and locations.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
 - 1. Verify that prepared soil and planting areas are ready to receive work.
 - 2. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 3. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
 - 4. Verify that required underground utilities are available in proper location and ready for use.
 - 5. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 6. Uniformly moisten excessively dry soil that is not workable or which is dusty.
 - 7. Saturate soil with water to test drainage.

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- B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF PLANTS, GENERAL

- A. Observe each plant after delivery and prior to installation for damage or other characteristics that may cause rejection of the plant. Notify Landscape Architect of any such condition.
- B. No more plants shall be distributed about the planting bed area than can be planted and watered on the same day.
- C. The outer surfaces of all plants in containers and boxes, including the top, sides and bottom of the rootball shall be shaved to remove circling, descending, and matted roots. Shaving shall be performed using clean saws, knives, sharp shovels or other suitable equipment that is capable of making clean cuts on the roots. Shaving shall remove a minimum of one inch of root mat or up to two inches as required to remove all root segments that are not growing reasonably radial to the trunk.
- D. Exposed Stem Tissue after Modification: The required root ball modifications may result in stem tissue that has not formed trunk bark being exposed above the soil line. If such condition occurs, wrap the exposed portion of the stem in a protective wrapping with a white filter fabric. Secure the fabric with biodegradable masking tape. Do not use string, twine, green nursery ties or any other material that may girdle the trunk if not removed.

3.03 SOIL PREPARATION

- A. Refer to Section 32 91 13 "Soil Preparation."
- B. Refer to Drawings for depth of amended soil in each planting area.

3.04 FERTILIZING

- A. Apply organic fertilizer in accordance with manufacturer's instructions.
- B. Apply after initial raking of planting soil.
- C. Mix thoroughly into planting soil to depths indicated on Drawings.
- D. Lightly water to aid the dissipation of fertilizer.

3.05 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil- bearing water runoff or airborne dust to adjacent properties and walkways.

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- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.06 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits: Excavate circular planting pits.
 - 1. Excavate planting pits with sides sloping inward at a 45 degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify bottom and sides of planting pit smeared or smoothed during excavation.
 - 2. Excavate approximately three times as wide as ball diameter for container-grown stock.
 - 3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
 - 4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
 - 5. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other amenities.
 - 6. Maintain supervision of excavations during working hours.
 - 7. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
- B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless the excavated soil is unsuitable for planting.
 - 1. Amend backfill soil per soil lab recommendations.
- C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
- D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.07 TREE AND SHRUB PLANTING

- A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Place plants for best appearance for review and final approval by Landscape Architect.

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- C. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- D. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 inches adjacent finish grades.
 - 1. Backfill: Planting soil or amended excavated soil if suitable, or import topsoil.
 - 2. Carefully remove rootball from container without damaging rootball or plant. Cut containers; do not pull plants out of containers by their stems or branches.
 - 3. Scarify sides and bottom of rootball with sharp, clean knife, 1/4-inch deep.
 - 4. Set plants plumb.
 - 5. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - 6. Continue backfilling process. Water again after placing and tamping final layer of soil. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.08 INSTALLATION OF WOOD HEADER

- A. Install edging where indicated. Mitre cut joints and connections at a 45-degree angle. Fasten each cut joint or connection with two galvanized nails. Anchor with wood stakes spaced up to 36 inches apart, driven at least 1 inch below top elevation of edging. Use two galvanized nails per stake to fasten edging, of length as needed to penetrate both edging and stake and provide 1/2-inch clinch at point. Pre-drill stakes if needed to avoid splitting.
- B. Replace stakes that crack or split during installation process.

3.09 INSTALLATION OF ACCESSORIES

- A. Wrap deciduous shade and flowering tree trunks and place tree protectors.

3.10 TREE STABILIZATION

- A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as indicated on Drawings.
 - 1. Stake all newly planted trees to prevent wind tip out.
 - 2. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.11 TREE AND SHRUB PRUNING

- A. Prune trees and shrubs according to standard professional horticultural and arboricultural practices, and as recommended in ANSI A300 Part 1. Obtain written approval for pruning from Landscape Architect prior to the work.
- B. Remove only dead, dying, split or broken branches.

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- C. Do not cut tree leaders. Do not thin or shape trees and shrubs unless specifically directed by Landscape Architect.
- D. Do not apply pruning paint to wounds.

3.12 GROUND COVER AND PERENNIAL PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs and vines in spacing indicated on Drawings in even rows with triangular spacing.
- B. Use amended native soil or import topsoil for backfill. Dig holes large enough to allow spreading of roots.
- C. Container-Grown Stock:
 - 1. Carefully remove root ball from container without damaging root ball or plant. Cut containers; do not pull plants out of containers by their stems or branches.
 - 2. Scarify sides and bottom of rootball with sharp, clean knife, 1/4-inch deep.
- D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.13 MULCHING

- A. Mulch backfilled surfaces of planting areas.
 - 1. Compost Mulch in Planting Areas: Apply consistent thickness of mulch over whole surface of planting area. Refer to Drawings for mulch thickness and finish level in respect to finish grade of adjacent hardscapes. Do not place mulch within 12 inches of tree trunks and within 6 inches of stems shrubs and perennials.
 - 2. Mineral Mulch in Bioretention Areas: Cobbles; refer to Drawings for types.
- B. Mineral Mulch in Mulch Surfacing areas: Refer to Drawings for types and locations.

3.14 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations, and only during the appropriate times in plants' life cycle. Do not apply to seeded areas.

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- C. Post-Emergent Herbicides (Selective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations and only during the appropriate times in plants' life cycle.

3.15 REPAIR AND REPLACEMENT

- A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Landscape Architect.
 - 1. Submit details of proposed pruning and repairs.
 - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
 - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.
- B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.
 - 1. Replacement Trees: Same species being replaced, of the same container size or larger.
 - 2. Replacements are at no additional cost to Owner.

3.16 BOULDERS

- A. Use boulders found and stockpiled on site first. Supplement quantity with newly procured boulders from stone yard.
 - 1. Procure from stone yard boulders to be placed in courtyard as specified on Drawings.
- B. Review Locations: Landscape Architect will approve final locations of all boulders at the job site prior to installation of soil and planting.
- C. Remove and replace boulders that are broken, chipped, stained or otherwise damaged.

3.17 CLEANING AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.
- C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.
- E. Plants will be rejected if a ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

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3.18 MAINTENANCE

- A. See Section 32 01 90 "Landscape Maintenance."
- B. Provide a separate maintenance contract for specified maintenance service.
- C. Maintenance Service for all plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period established in Section 32 01 90 "Landscape Maintenance."
- D. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Maintenance shall include, but not be limited to, the following activities:
 - 1. Cultivate and weed plant beds and tree pits.
 - 2. Remove dead or broken branches and treat pruned areas or other wounds.
 - 3. Neatly trim plants where necessary.
 - 4. Immediately remove clippings after trimming.
 - 5. Replace mulch when deteriorated.
 - 6. Maintain wrappings and stakes. Repair or replace accessories when required.
- E. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- F. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

END OF SECTION

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SECTION 32 96 00 - TRANSPLANTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes transplanting existing site trees by digging and boxing, storing on site, and maintenance prior to and after planting in new locations.

1.03 RELATED REQUIREMENTS:

- A. Section 01 56 39 – Temporary Tree and Plant Protection, for protecting, trimming, pruning, repairing, and replacing existing trees to remain.
- B. Section 32 01 90 – Landscape Maintenance, for onset and duration of maintenance period.
- C. Section 32 91 13 – Soil Preparation.
- D. Section 32 93 00 – Plants, for new trees from nursery-grown sources.

1.04 DEFINITIONS

- A. General: See definitions in ANSI A300 (Part 6) and in ANSI Z60.1 pertaining to field-grown trees, except as otherwise defined in this Section.
- B. Caliper: Diameter of a trunk as measured by a diameter tape at a height 6 inches above the root flare for trees up to, and including, 4-inch size at this height; and as measured at a height of 12 inches above the root flare for trees larger than 4-inch size.
- C. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape at a height 54 inches above the ground line for trees with caliper of 8 inches or greater as measured at a height of 12 inches above the root flare.
- D. ISA: International Society of Arboriculture.
- E. Root-Ball Depth: Measured from bottom of trunk flare to the bottom of root ball.
- F. Root-Ball Width: Measured horizontally across the root ball with an approximately circular form or the least dimension for non-round root balls, not necessarily centered on the tree trunk.
- G. Root Flare: Also called "trunk flare." The area at the base of the tree's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

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1.05 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to transplanting work include, but are not limited to, the following:
 - a. Schedule. Verify availability of materials, personnel, equipment, and unimpeded access needed to make progress and avoid delays.
 - b. Identification on site of all plants to be transplanted.
 - c. Tree and plant protection.
 - d. Tree maintenance.
 - e. Arborist's responsibilities.
 - f. Tree storage location.
 - 2. Obtain from Owner list of all plants to be transplanted with assigned monetary value to each plant. Establish methods and timing of payments, should Owner prefer monetary compensation for damaged or lost plants in lieu of replacement.

1.06 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each of the following:
 - 1. Proprietary Root-Ball-Stabilization Device: One unit.
 - 2. Slow-Release Watering Device: One unit of each type.
- C. Pruning Schedule: Written schedule prepared by and independent arborist detailing scope and extent of pruning each tree in preparation for and subsequent to transplanting. Schedule shall include:
 - 1. Species and size of plant.
 - 2. Location on site plan. Include unique identifier for each.
 - 3. Reason for pruning.
 - 4. Seasonal limitations on pruning.
 - 5. Preparatory Pruning: Time schedule and description of preparatory pruning to be performed.
 - a. Indicate time in months preceding the extraction of the trees.
 - b. Indicate diameter of root ball and depth of root pruning for each tree.
 - 6. Description of root and crown pruning during and subsequent to transplanting.
 - 7. Description of maintenance following pruning.

1.07 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified tree-service firm and an independent certified arborist.
- B. Certification: From arborist, certifying that transplanted trees have been protected during construction and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance Recommendations: From arborist, recommended procedures to be followed by Contractor during construction and maintenance period, and for care by Owner after completing

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the Work.

1. Submit before completing the Work.

- D. Existing Conditions: Documentation of existing trees indicated to be transplanted, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
1. Use sufficiently detailed photographs or video recordings. Provide a minimum of one overall photo per plant. Provide two close-up photos of each wound or damage if applicable.
 2. Include plans and notations to indicate specific conditions, wounds and damage of each tree to be transplanted.
 3. Mark all documentation with date indicating when photographs or videos were taken.
 4. Color shall accurately depict hue condition of foliage and bark.
 5. Identify location of tree or plant on plans.

1.08 QUALITY ASSURANCE

- A. Tree-Service Firm Qualifications: An experienced landscaping contractor or tree-moving firm that has successfully completed transplanting work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
1. Arborist Qualifications: Certified Arborist as certified by ISA.
 - a. Arborist to submit all communication to Construction Manager.
- B. Tree-Transplanting Program: Prepare a written plan by arborist for transplanting trees for the whole Project, including each phase or process, tree maintenance, and protection of surrounding materials during operations. Describe in detail the materials, methods, and equipment to be used for each phase of the transplanting work.
1. Include transplanting times appropriate for each species.
 2. Include a transplanting schedule, coordinate with the overall Project schedule.
 3. Include site plans clearly marked to show tree-moving routes from extraction to planting locations. Indicate proposed equipment, weight, and turning radii.
 4. Show details of temporary protective barriers where needed.
 5. Include care and maintenance provisions and eventual removal of tree stabilization.
 6. Refer to Section 01 56 39 "Temporary Tree and Plant Protection" for measures to be taken to protect existing trees and their roots during transplanting operations.

1.09 STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or trees.

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2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Accompany each delivery with appropriate certificates.
- C. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees in such a manner as to destroy their natural shape.
 - D. Handle trees by root ball, not by stems and trunks, nor by branches. Do not drop trees.
 - E. Move trees to a temporary location at first, until preparations for planting have been completed. Set trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist. Water and maintain trees in temporary location per section 32 93 00 "Planting" and section 32 01 90 "Landscape Maintenance."

1.10 FIELD CONDITIONS

- A. Field Measurements: Verify final grade elevations and final locations of trees and construction contiguous with trees by field measurements before proceeding with transplanting work. Perform transplanting to final location only after finish grades are established.
- B. Seasonal Restrictions: Transplant trees to their final location during early spring.
- C. Weather Limitations: Proceed with transplanting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Do not transplant during excessively wet conditions. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- D. Coordination with ground cover planting: Perform transplanting to final locations before planting ground covers or other understory planting in surrounding areas.
 1. When transplanting after planting ground covers, protect adjacent plants, and promptly repair damage caused by transplanting operations.

1.11 WARRANTY

- A. Installer's Special Warranty: Tree-service firm agrees to repair or replace trees and related materials that fail within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth except for defects resulting from abuse, lack of adequate maintenance or neglect by Owner, or incidents that are beyond Contractor's control.
 - b. Death and unsatisfactory growth is defined as more than 25 percent dead or in an unhealthy condition or failure to meet general performance requirements at end of warranty period.
 - c. Structural failures including trees falling or blowing over.
 - d. Faulty performance of materials and devices related to tree plantings including tree stabilization and watering devices.

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2. Warranty Periods from Date of Transplanting Completion:
 - a. Trees: 12 months.
3. Include the following remedial actions as a minimum:
 - a. Remove dead trees and trees with unsatisfactory growth at end of warranty period; replace when directed.
 - b. A limit of one replacement of each tree will be required except for losses or replacements due to failure to comply with requirements.
 - c. Replace materials and devices related to tree plantings.
 - d. Provide extended warranty for period equal to original warranty for all replaced trees.

1.12 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Provide tree maintenance by skilled employees. Begin maintenance immediately after trees are removed from ground, during storage, and after planting in their final location. Continue until plants are healthy and well established but for not less than maintenance period established in Section 32 01 90 "Landscape Maintenance."

PART 2 PRODUCTS

2.01 PLANTING MATERIALS

- A. Backfill Soil: Amended site soil or excavated soil mixed with import topsoil of suitable moisture content and granular texture for placing and compacting in planting pit around tree, and free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.
 1. Refer to Section 32 91 13 "Soil Preparation."

2.02 TREE-STABILIZATION MATERIALS

- A. Trunk-Stabilization Materials: Refer to Drawings and Section 32 93 00 "Plants."

2.03 TEMPORARY WATERING DEVICES

- A. Watering Pipe: PVC pipe 4 inches in diameter, site-cut to length as required, and with snug-fitting removable cap.
- B. Slow-Release Watering Device: Standard product manufactured for drip-irrigation of plants and emptying its water contents over a period of 2 to 9 hours; manufactured from UV-light stabilized nylon-reinforced polyethylene sheet, PVC, or HDPE plastic.

2.04 MISCELLANEOUS PRODUCTS

- A. Organic Mulch:

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1. Apply compost mulch as specified in Section 32 93 00 "Plants" in temporary tree location and again in permanent location.
- B. Burlap: Non-synthetic, biodegradable, without dyes.

PART 3 EXECUTION

3.01 PERFORMANCE REQUIREMENTS

- A. General Performance: Transplanted trees shall be healthy and resume vigorous growth within one year of transplanting without dieback due to defective extracting, handling, planting, maintenance, or other defects in the Work.
- B. Perform transplanting work in the presence and supervision of an independent Arborist.

3.02 EXAMINATION

- A. Erosion and Sedimentation Control: Verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross transplanting areas.
 1. Refer to Sedimentation and Erosion Control Plan.
- B. For Owner's record, prepare written report, endorsed by an independent certified arborist, listing conditions detrimental to transplanting work and tree protection and health.
- C. Proceed with transplanting only after unsatisfactory conditions have been corrected.

3.03 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, other facilities, turf areas, and other plants and planting areas from damage caused by transplanting operations.
- B. Locate and clearly identify trees for transplanting. Loosely wrap a bright-colored vinyl tape around each tree at 54 inches above the ground.
- C. Lay out individual transplant locations. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before transplanting. Make minor adjustments as required.

3.04 PREPARATORY PRUNING

- A. Root Pruning: Perform preparatory root pruning under direction of arborist as far in advance of extracting each tree as the Project Schedule allows.
 1. Dig exploratory pits or trench by hand around perimeter of tree at indicated root-ball width to determine locations of main lateral roots. Do not use a backhoe or other equipment that rips, tears, or pulls roots.

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2. Root-Ball Width: Minimum 12 inches of root-ball diameter, or least dimension for non-round root balls, for each inch of tree caliper being transplanted.
 3. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking.
 4. Comb soil with narrow-tine spading forks to expose roots with minimal damage to roots.
 5. Cut exposed roots manually with clean, sharp pruning instruments; do not break, tear, chop, or slant cuts. Do not use backhoe or other equipment that rips, tears, or pulls roots.
 6. Do not paint or apply sealants on cut root ends.
 7. Backfill trench with excavated soil.
- B. Crown Pruning (Tip Pruning):
1. Do not perform preparatory crown pruning.

3.05 EXCAVATION AND PLANTING EQUIPMENT

- A. Tree Spade: Track-mounted mechanized tree mover; sized according to manufacturer's size recommendation for each tree being transplanted.

3.06 EXCAVATING PLANTING PITS

- A. Refer to section 32 93 00 "Plants" for tree pit size and other requirements, and for tree pit drainage.

3.07 EXTRACTING TREES

- A. General: Extract trees under supervision of the arborist.
- B. Orientation: Mark the north side of each tree with chalk before extracting.
- C. Root-Ball Width: Minimum 12 inches of root-ball diameter, or least dimension for non-round root balls, for each inch of tree caliper being transplanted.
1. Out-of-Season Planting: If planting before or after the in-season period for tree, provide a minimum root-ball diameter of 16 inches for each inch of tree caliper being transplanted.
- D. Root-Ball Depth: As determined by the arborist for each species and size of tree and for site conditions at original and planting locations.
- E. Digging:
1. Dig and clear a pit by hand to the depth of the root system. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 2. Comb soil with narrow-tine spading forks to expose roots with minimal damage to roots.
 3. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking.
 4. Cut exposed roots manually with clean, sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not paint or apply sealants on cut root ends.
 5. Construct box tight against root system sides and bottom as pit is dug. Brace and support box to prevent breaking of root ball.

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6. Temporarily support and protect exposed roots from damage until they are permanently redirected and covered with soil. Cover roots with burlap, keep them moist until planted.

3.08 PLANTING

- A. Planting Standard: Perform planting according to ANSI A300, Part 6 unless otherwise indicated.
- B. Before planting, verify that root flare is visible at top of root ball. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- C. Ensure that root flare is visible after planting.
- D. Remove injured roots by cutting cleanly; do not break. Do not paint or apply sealants on cut root ends.
- E. Orientation: Position the tree so that its north side, marked before extracting, is facing north in its new location.
- F. Set tree plumb in center of planting pit with top of root flare 2 inches above adjacent finish grades.
 1. Use amended native soil for backfill.
 2. If area under the tree was initially dug too deep, add backfill to raise it to the correct planting area soil level and thoroughly tamp the added soil to prevent settling.
 3. After placing some backfill around root ball to stabilize plant, begin backfilling.
 4. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 5. Redirect exposed root ends downward in backfill areas where possible. Hand-expose roots as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.
 6. Continue backfilling process. Water again after placing and tamping final layer of soil.
- G. Watering Pipe: During backfilling, install watering pipe 4 feet deep into the planting pit outside the root ball as indicated on Drawings.
- H. Slopes: When planting on slopes, set the tree so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.09 CROWN PRUNING AFTER TRANSPLANT

- A. Prune branches as directed by arborist.
 1. Prune to remove only injured, broken, dying, or dead branches. Do not prune for shape.
 2. Do not remove or reduce living branches to compensate for root loss caused by cutting root system or to improve natural tree form.

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3. Pruning Standards: Perform pruning according to ANSI A300, Part 1.
- B. Unless specifically directed by arborist and acceptable to Landscape Architect and Owner, do not cut tree leaders.
- C. Cut branches with clean, sharp pruning instruments; do not break or chop.
- D. Do not paint or apply sealants to wounds.
- E. Provide subsequent maintenance during Contract period as recommended by arborist.
- F. Chip removed branches and spread over areas identified by Architect.

3.10 TREE STABILIZATION

- A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise directed by arborist.
 1. Upright Staking and Tying: Stake only as required to prevent wind tip out. Use four stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend to the dimension shown on Drawings above grade. Set stakes vertical and space to avoid penetrating root balls or root masses.
 2. Refer to section 32 93 00 "Plants."

3.11 MULCHING

- A. Organic Mulch: Apply 3-inch average thickness of bark mulch extending 12 inches beyond edge of individual planting pit and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 12 inches of tree trunks or within 6 inches of shrub stems.
 1. Refer to section 32 93 00 "Plants" for type of acceptable mulch.

3.12 INSTALLING TEMPORARY SLOW-RELEASE WATERING DEVICE

- A. Provide one device for each tree during storage period in temporary location.
- B. Place device on top of the mulch at base of tree and fill with water according to manufacturer's written instructions.

3.13 TREE MAINTENANCE

- A. Perform tree maintenance as recommended by arborist.
- B. Maintain trees by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- C. From time of tree extraction measure soil moisture adjacent to edge of each root ball weekly. Record findings and weather conditions.
- D. Fill areas of soil subsidence with amended backfill soil. Replenish mulch to 3 inch depth.

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- E. Apply treatments as required to keep tree materials, planted areas, and soils free of pests and pathogens or disease. Use only integrated pest management practices to avoid the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.14 REPAIR AND REPLACEMENT

- A. General: Repair or replace transplanted trees and other plants indicated to remain or be relocated that are damaged by construction operations, in a manner recommended by the arborist and approved by Landscape Architect.
 - 1. Verify with Owner whether damaged trees are to be repaired, replaced in kind, or compensated by their monetary value.
 - a. Establish methods and timing of payments to Owner.
 - 2. Submit details of proposed pruning and repairs.
 - 3. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
 - 4. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.
- B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.
 - 1. Provide new trees of same size and species as those being replaced for each tree.

3.15 CLEANUP AND PROTECTION

- A. During transplanting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect trees from damage due to transplanting operations and operations of other contractors and trades. Maintain protection during transplanting and maintenance periods. Treat, repair, or replace damaged plantings.
- C. After planting and before Substantial Completion, remove tags, markings, tie tape, labels, wire, burlap, and other debris from transplanted trees, planting areas, and Project site.

3.16 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Except for materials indicated to be recycled, remove excess excavated material, waste materials, displaced plants, trash, and debris, and legally dispose of them off Owner's property.
 - 1. Excess soil may remain on site in locations as directed by Landscape Architect.
 - 2. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Landscape Architect.

END OF SECTION

SECTION 33 10 00 – SITE WATER 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.
- B. Additional information concerning earthwork may be found in the geotechnical investigation report; Geotechnical Design Geological Hazards Evaluation Report Horticultural Center Merritt College, August 07, 2020 by Terraphase Engineering, available by request. All requirements of this report shall be followed unless noted otherwise.
- C. Stormwater Pollution Prevention Plan (SWPPP), refer to Section 00 73 13 – SPECIAL CONDITIONS.

1.2 SUMMARY

- A. Section includes installation requirements and procedures for site underground potable water from connection to the Campus main to within 3 feet from face of building mat slab. Refer to landscape architecture specifications for irrigation water system specifications.
 - 1. Domestic water services and appurtenances
 - 2. Fire Water Service and appurtenances
 - 3. Irrigation water service up to the meter.
- B. Related Sections:
 - 1. Section 31 22 00 – EARTHWORK AND GRADING
- C. Piping and Appurtenances Within Building Slab Footprint: Refer to plumbing and Fire Suppression Sprinkler specifications for components within this area.
- D. Water service installation, service and appurtenances to meet EBMUD and Peralta Community College Districts requirements.

1.3 DEFINITIONS AND ACRONYMS

- A. CFC: California Fire Code
- B. CI: Cast Iron
- C. DI: Ductile Iron
- D. DSP: Dry Standpipe
- E. FDC: Fire Department Connection
- F. FL: Flange Joint
- G. MJ: Mechanical Joint
- H. NFPA: National Fire Protection Association

- I. PVC: Polyvinyl chloride (Plastic)

1.4 SUBMITTALS

- A. Fire Shop Drawings
 - 1. Shop drawings for all underground fire services shall be prepared and submitted for approval by Fire Protection Consultant.
 - 2. Drawings shall adhere to all applicable CFC, EBMUD, NFPA and to City of Oakland Fire Protection District requirements as applicable.
 - 3. Installation shall be included to within 3 ft from face of building slab.
- B. The following manufacturer product data shall be submitted to Owner's Representative for review.
 - 1. Pipe, Fittings, and Appurtenances.
 - 2. Trench Bedding and Backfill Materials
 - 3. All fire equipment shall be UL listed or FM approved as required by Oakland Fire Department and EBMUD Standards and Specifications.

1.5 PERFORMANACE REQUIREMENTS

- A. Pressure rating per applicable utility and applicable codes.

1.6 DELIVERY, STORAGE AND HANDLING

- A. 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.
- B. Do not store plastic pipe and fittings in direct sunlight. Support to prevent sagging and bending.
- C. Protect pipe, fittings, and seals from dirt and damage.
- D. Protect flanges, fittings and metal specialties from moisture and dirt.

1.7 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Peralta Community College District Standards and Specifications.
 - 2. EBMUD Standards and Specifications.
 - 3. Comply with California Plumbing Codes, latest Edition.
 - 4. Comply with California Fire Code, latest Edition.
 - 5. Comply with NFPA codes 24 and 13 as adopted by the California Fire Code.

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Domestic Water Service: Do not interrupt service to facilities occupied by existing tenant unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify the District no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without the Distric't written permission.

- B. Interruption of Existing Fire Water Service: Do not interrupt service to facilities whether occupied or not unless appropriate fire suppression measures are been provided as applicable including:
 - 1. Notify the District no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Fire Marshal's written permission as applicable.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTION

- A. Refer to Approved List of Backflow Prevention Devices by EBMUD.

2.2 PIPE AND FITTINGS

- A. Exterior Underground Water Distribution Piping:
 - 1. Domestic Water Pipe (Within Property): IPS Solvent Weld Grey Schedule 80 PVC manufactured per ASTM D1785 and shall be installed per ASTM D2855. Joints shall conform to ASTM D2672 with solvent cement to ASTM D25564 and primer to ASTM F656.
 - 2. Fire Water Pipe (Within Property): Refer to Fire Protection Plans.
 - 3. Fittings: Ductile-Iron Fittings: AWWA C110, cement line with rubber gaskets conforming to AWWA C111
 - 4. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
 - 5. Manufacturers:
 - a. PVC piping and fittings:
 - 1) JM Eagle Corporation.
 - 2) North American Pipe Corporation.
 - 3) Or equal.
 - b. Ductile piping and fittings: US Pipe or Pacific States Cast Iron Pipe Co. Basis of design for custom fabricated spools as necessary.
- B. The maximum joint deflection shall not exceed the maximum allowable deflection allowed by the fitting manufacturer and the pipe manufacturer. The contractor shall submit the manufacturer's data sheet for the pipe and fittings to verify the maximum deflection. Where pipe deflections are needed in excess of the manufacturer's maximum allowable deflection, the appropriate fitting shall be used.

2.3 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use flanged-end valves for installation in vaults. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation. Fire water valves shall be UL listed for fire service installation.
 - 1. Manufacturer:
 - a. Clow Valve Company.
 - b. Mueller Company.
 - c. Or equal.

2.4 FIRE DEPARTMENT CONNECTION

- A. Fire department connection with location per plan to include:
 - 1. Minimum two 2-1/2" FDC inlets using female swivel connection.
 - 2. Provide appropriate signage with building address in accordance with NFPA 24 requirements.
 - 3. Manufacturer: American Fire Protection, Guardian Fire Equipment or equal.

2.5 FIRE HYDRANT

- A. New hydrant installation with locations per plan to include:
 - 1. Install dedicated control valve connected directly to tee or tapping sleeve fitting on water main using a flange by flange connection.
 - 2. All hydrants shall include a breakaway check valve. Clow or equal.
 - 3. Use break away bolts only at flanges designated per plan.
 - 4. All hydrants shall be rated for 200 psi working pressure.
 - 5. Fire hydrant shall be a wet barrel hydrant, Clow Model #865 (Basis of design)

2.6 CONNECTIONS

- A. Connect water service to water main using tapping sleeve or tapping valve.
- B. Domestic water service shall include gate valve at connection with water main.
- C. Manufacturer:
 - 1. Mueller Company.
 - 2. American Cast Iron Pipe Company.
 - 3. Or equal.

PART 3 - EXECUTION

3.1 WATER METER INSTALLATION

- A. Water-Main Connection: Tap water main according to requirements of size and in location indicated on the plans.
- B. Make connections larger than NPS 2 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.
- C. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
- D. Depth of cover
 - 1. Provide minimum depth of cover of 36 inches below finish grade.
- E. 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.

3.2 JOINT CONSTRUCTION

- A. Make pipe joints according to the following:
 - 1. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
 - 2. 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 and pipe manufacturer's written instructions.
 - 3. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.3 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 restrainer glands.
 - 4. Bolted flanged joints.
 - 5. Pipe clamps and tie rods.
- B. Thrust Restraint shall be installed all tees, wyes, caps, plugs, bends and valves and hydrants with either the use of restrained joints or concrete thrust blocks per plan.

3.4 TESTING AND ACCEPTANCE

- A. Agency Tests
- B. All fire water piping shall be inspected by EBMUD and City of Oakland Fire Department. The contractor shall give 72 hours' notice before backfilling.
- C. 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.
- D. Hydrostatic Tests: Test at 200 psig or 50 psig plus the maximum working pressure, whichever is greater.
 - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
 - 2. Maximum working pressure shall include the maximum system pressure fluctuation. If the system pressure fluctuation cannot be determined, the maximum working pressure shall be 50 psig plus the maximum observed system static pressure.

3.5 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench or boring of conduit for underground water-distribution piping. Locate below finished grade, directly over piping.

3.6 CLEANING

- A. Clean and disinfect water-distribution piping as follows:

1. Per Department of Water and Power System Standards.
2. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
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 NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

END OF SECTION

SECTION 33 31 00 – SITE SANITARY SEWER

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. Additional information concerning earthwork may be found in the geotechnical investigation report; Geotechnical Design Geological Hazards Evaluation Report Horticultural Center Merritt College, August 07, 2020 by Terraphase Engineering, available by request. All requirements of this report shall be followed unless noted otherwise.

1.2 SUMMARY

- A. This Section Includes gravity-flow, non-pressure sanitary sewer service from the connection with the public sanitary sewer main to within 3 ft from face of building foundation slab for the following components:
 - 1. Pipes and fittings.
 - 2. Cleanouts.
 - 3. Maintenance Holes.
 - 4. Encasement for piping.
 - 5. Gray Water Ready Piping and appurtenances
 - 6. Refer to plumbing specifications for proposed grease interceptor requirements and specifications.
- B. Related Sections:
 - 1. Section 31 23 33 – Trenching, Backfilling and Compacting
 - 2. Section 33 22 00 – Earthwork and Grading
 - 3. Division 22 – Plumbing, including outdoor sinks and sediment traps for indoor and outdoor sinks, which connect to sanitary sewer system
- C. Piping and Appurtenances Within Building Slab Footprint: Refer to plumbing specifications for components within this area.

1.3 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.
- B. ID: Inner Diameter.
- C. NPS: Normal Pipe Size.
- D. OD: Outside Diameter.
- E. Maintenance Hole: Term previously known as "Manhole."

1.4 SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 - 1. Pipe, Fittings, and Appurtenances.

2. Trench Bedding and Backfill Materials.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store pipe materials with adequate support to prevent sagging and bending.
- B. Do not store plastic pipe and fittings in direct sunlight
- C. Protect pipe, pipe fittings and seals from dirt and damage.
- D. Protect flanges, fittings and metal specialties from moisture and dirt.
- E. Handle maintenance holes according to manufacturer's written rigging instructions.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements:
 1. Comply with California Plumbing Codes, latest Edition.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 1. Notify District no fewer than two days in advance of proposed interruption of service.
 2. Do not proceed with interruption of service without District's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

- A. Exterior Underground Sewer Distribution Piping:
 1. HDPE pipe shall conform to ASTM F714-94, "Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter," or ASTM D3035-93 "Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.").
 2. HDPE pipe shall have a Plastic Pipe Institute (PPI) material designation of PE 3408, a cell classification of PE 345434C per ASTM D3350, and have an established hydrostatic design basis of 1600 psi at 73 degrees F
 3. All HDPE fittings shall be manufactured from the same resin type, grade, and cell classification as the pipe, and shall be fully pressure rated

2.2 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

- C. Ring-Type, Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
 - 1. Available Manufacturers:
 - a. Fernco Inc.
 - b. Logan Clay Products Company (The).
 - c. Mission Rubber Company; a division of MCP Industries, Inc.
 - d. Or equal.
- D. Nonpressure-Type, Rigid Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Available Manufacturers:
 - a. ANACO.
 - b. Or equal.

2.3 CLEANOUTS

- A. Box Types:
 - 1. Christy G5C or approved equal.
 - 2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, water-tight brass cover with the word "SEWER" or "S.S." on the cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
 - 3. Top-Loading Classification(s): Medium Duty in Foot-traffic/landscape areas, Heavy Duty in vehicle-traffic areas.
 - 4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.4 MAINTENANCE HOLES

- A. Standard Precast Concrete Maintenance Holes:
 - 1. Shall conform to ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - 2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
 - 3. Cover: 24 inches (600 mm) clear opening and shall be marked "SANITARY SEWER"
 - 4. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
 - 5. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
 - 6. Riser Sections: 4-inch (102-mm) minimum thickness, and lengths to provide depth indicated.
 - 7. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
 - 8. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
 - 9. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into maintenance hole walls, for each pipe connection.
 - 10. Steps: ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of maintenance hole to finished grade is less than 60 inches (1500 mm).

11. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching maintenance hole frame and cover, and of height required to adjust maintenance hole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
- B. Maintenance Holes Frames and Covers:
 1. ASTM A 536, Grade 60-40-18, ductile iron designed for A-16/H20, structural loading. Include 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch (102-mm) minimum width flange, and 26-inch- (660-mm-) diameter cover, using wording equivalent to "SANITARY SEWER"

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 31 22 00 – Earthwork and Grading and 31 23 33 – Trenching, Backfilling and Compacting.

3.2 GREASE INTERCEPTOR

- A. Contractor to ensure proper lifting equipment is available on site for delivery of tank.

3.3 PIPING APPLICATIONS

- A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
- C. Gravity-Flow, Nonpressure Sewer Piping: Use the following pipe materials for each size range:
- D. NPS 4-8: PVC SDR 26 profile gravity sewer pipe and fittings, gaskets, and gasketed joints.

3.4 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

- D. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe jacking process of microtunneling.
- E. Install gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 2 percent, unless otherwise indicated. Contractor to notify the District if pipe cannot be installed at slope indicated on the Plans and await further direction.
 - 2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
 - 3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 4. Install piping with 48-inch minimum cover.
- F. Clear interior of piping and maintenance holes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.
- G. Maintenance holes:
 - 1. Install maintenance holes, complete with appurtenances and accessories indicated.
 - 2. Install precast concrete maintenance hole sections with sealants according to ASTM C891.
 - 3. Where specific maintenance hole construction is not indicated, follow maintenance hole manufacturer's written instructions.
 - 4. Set tops of frames and covers flush with finished surface of maintenance holes that occur in pavements unless otherwise indicated in Drawings. Set tops 3-inch (76-mm) above finished surface elsewhere unless otherwise indicated in Drawings.

3.5 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
 - 2. Join dissimilar pipe materials with nonpressure-type, flexible couplings.

3.6 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use Heavy-Duty, top-loading classification in all cases unless otherwise noted on the Plans.
 - 2. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.7 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 22 Section Sanitary Waste and Vent Piping.
- B. Make connections to existing piping and underground maintenance holes.
 - 1. Make branch connections from side into existing piping, NPS 4 to NPS 20 Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye

- with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make connections from side into underground maintenance holes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or maintenance hole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 3. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
 4. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 5. Protect existing piping and maintenance holes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.8 CLOSING ABANDONED SANITARY SEWERAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place on the Plans. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
- B. Close open ends of piping with threaded metal caps, plastic plugs, cement slurry, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- C. Backfill to grade according to Section 31 22 00 - Earthwork and Grading and Section 31 23 33 - Trenching, Backfilling and Compacting.

3.9 IDENTIFICATION

- A. Materials and their installation are specified in Section 31 22 00 Earthwork and Grading and Section 31 23 33 Trenching, Backfilling and Compacting. Arrange for installation of green warning tapes directly over piping and at outside edges of underground maintenance holes.
 1. Use warning tape detectable warning tape over ferrous piping.
 2. Use detectable warning tape over nonferrous piping and over edges of underground maintenance holes.

3.10 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
- B. Defects requiring correction include the following:
 1. Alignment: Less than full diameter of inside of pipe is visible between structures.
 2. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 3. Crushed, broken, cracked, or otherwise damaged piping.
 4. Infiltration: Water leakage into piping.
 5. Exfiltration: Water leakage from or around piping.

- C. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
- D. Reinspect and repeat procedure until results are satisfactory.
- E. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
- F. Do not enclose, cover, or put into service before inspection and approval.
- G. Test completed piping systems according to requirements of authorities having jurisdiction.
- H. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
- I. Submit separate report for each test.
- J. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
 - 1. Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile of pipe, during 24-hour period.
 - 2. Close openings in system and fill with water.
 - 3. Purge air and refill with water.
 - 4. Disconnect water supply.
 - 5. Test and inspect joints for leaks.
- K. Maintenance holes: Perform hydraulic test according to ASTM C 969.
- L. Leaks and loss in test pressure constitute defects that must be repaired.
- M. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.11 CLEANING

- A. Clean interior of piping of dirt and superfluous material. Flush with potable water.

END OF SECTION

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SECTION 33 40 00 – SITE 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.
- B. Additional information concerning earthwork may be found in the geotechnical investigation report; Geotechnical Design Geological Hazards Evaluation Report Horticultural Center Merritt College, August 07, 2020 by Terraphase Engineering, available by request. All requirements of this report shall be followed unless noted otherwise.

1.2 SUMMARY

- A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:
 - 1. Cleanouts.
 - 2. Drains.
 - 3. Pipes and fittings.
 - 4. Catch basins.
 - 5. Pipe outlets.
- B. Related sections include the following:
 - 1. Section 31 22 00 – Earthwork and Grading
 - 2. Section 31 23 33 – Trenching, Backfilling and Compacting
 - 3. Division 07 – for roof drainage and downspouts

1.3 DEFINITIONS & ACRONYMS

- A. PE: Polyethylene plastic.
- B. HDPE: High Density Polyethylene Plastic.
- C. PVC: Polyvinyl chloride plastic.
- D. Maintenance Hole: Term previously known as “Manhole.”

1.4 SUBMITTALS

- A. Shop Drawings
- B. Product data for the following:
 - 1. Special pipe fittings.
 - 2. Solid-wall pipe and fittings.
 - 3. Perforated pipe and fittings.
 - 4. Perforated underdrains and perimeter drains.
 - 5. Drain grates, including the grates with openings ½-inch or less to meet DSA regulations.
 - 6. Cleanouts.
 - 7. Maintenance Hole.

8. Valves.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle maintenance holes and catch basins according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 1. Notify District no fewer than two days in advance of proposed interruption of service.
 2. Do not proceed with interruption of service without District's written permissions.

PART 2 - PRODUCTS

2.1 PE PIPE AND FITTINGS

- A. Corrugated PE Drainage Pipe and Fittings NPS 10 and Smaller: AASHTO M 252M, Type S, with smooth waterway for coupling joints.
 1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
 2. Available Manufacturers:
 - a. Hancor Systems— "Blue Seal" Corrugated PE pipe
 - b. ADS, Inc.
 - c. Or equal.
- B. Perforated Pipes for Perimeter and Underdrains
 1. Pipe shall be high density polyethylene (HDPE), conforming to AASHTO M252, Type S or to AASHTO M294, Type S, as applicable for the pipe size, and to ASTM F2648.
 2. Polyethylene material shall conform with cell classification 42440C for 4 inch through 10 inch diameters, and to 435400C for larger sizes, per AASHTO D3350.
 3. Pipe shall be double wall with a smooth interior and annular exterior corrugations.
 4. Couplings shall be silt-tight, conforming to the requirements of AASHTO M252, AASHTO M294, or ASTM F2306.
 5. Perforated pipe shall provide a minimum of 0.9 square inches of opening area per linear foot of pipe, evenly divide among three holes spaced at 120 degrees around the pipe circumference.

2.2 PVC PIPE AND FITTINGS

- A. PVC Gravity Sewer Piping:
 1. Pipe and Fittings: ASTM F 679, Schedule 40 PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

2.3 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 - 1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.4 CLEANOUTS

- A. Plastic Cleanouts:
 - 1. Manufacturers:
 - a. NDS, Inc.
 - b. Zurn Light Commercial Products Operation; Zurn Plumbing Products Group
 - c. Or equal.
 - 2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping. (To be used within landscape planters that receive little to no traffic, per plans.)
- B. Cast-Iron Cleanouts:
 - 1. Manufacturers:
 - a. Smith, Jay R. Mfg. Co.
 - b. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
 - c. Or equal.
 - 2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, water-tight brass cover with the word "STORM" on the cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
- C. Top-Loading Classification(s): Medium Duty in Foot-traffic/landscape areas, Heavy Duty in vehicle-traffic areas.
- D. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.5 AREA DRAINS

- A. Area Drains with Atrium Drop-In Grates (within landscape areas only):
 - 1. Description: Square body with round atrium drop-in grate made to fit round or square basins, or with adaptors to fit corrugated single wall pipe or PVC pipe risers.
 - 2. Material/Finish/Color: Polyethylene, Black.
 - 3. Sizes and Locations per the Drawings.
 - 4. Top-Loading Classification(s): Medium Duty in Foot-traffic/landscape areas.
- B. Area Drains with Round or Square Drop-In Grates (within paved areas only):
 - 1. Description: Drop-in grate made to fit round or square basins, or with adapters to fit corrugated single wall pipe or PVC pipe risers.
 - 2. Material / Finish / Color: Polyethylene, Black
 - 3. Sizes and locations per the Drawings.
 - 4. All grates and covers within the path of travel must be heel proof and ADA compliant.

5. Top-Loading Classification(s): Medium Duty in Foot-traffic/landscape areas, Heavy Duty in vehicle-traffic areas.

2.6 TRENCH DRAINS

- A. Trench Drains:
 1. Description: ASME A112.6.3, 6-inch wide top surface, rectangular body with anchor flange or other anchoring device, and rectangular grate. Include units of total length indicated and quantity of bottom outlets with inside call or spigot connections, of sizes indicated. Minimum channel bottom slope must be 0.5% unless noted otherwise in Drawings.
 2. Material/Finish/Color: Polyethylene, Black.
 3. Top-Loading Classification(s): medium Duty in Foot-traffic/landscape areas, Heavy Duty in vehicle-traffic areas.
 4. All grates and covers within the path of travel must be heel proof and ADA compliant.

2.7 MAINTENANCE HOLES

- A. Standard Precast Concrete Maintenance Holes:
 1. Shall conform to ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 2. Diameter: 48 inches minimum unless otherwise indicated.
 3. Cover: 24 inches clear opening and shall be marked "STORM DRAIN"
 4. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
 5. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
 6. Riser Sections: 4-inch (102-mm) minimum thickness, and lengths to provide depth indicated.
 7. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
 8. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
 9. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into maintenance hole walls, for each pipe connection.
 10. Steps: ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of maintenance hole to finished grade is less than 60 inches (1500 mm).
- B. Maintenance Holes Frames and Covers
 1. ASTM A 536, Grade 60-40-18, ductile iron designed for A-16/H20, structural loading. Include 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch (102-mm) minimum width flange, and 26-inch- (660-mm-) diameter cover, using wording equivalent to "STORM SEWER."

2.8 CATCH BASIN AND JUNCTION BOXES

- A. Standard Precast Concrete Drop Inlet/Catch Basin Structures:
 1. Manufacturers:

- a. US Concrete Precast Group.
 - b. Jensen Precast.
 - c. Or equal.
 2. Description: ASTM C 478, precast reinforced concrete, of depth indicated, with provision for sealant joints. Square in shape.
 3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section.
 4. Width: 12 inches, 18 inches, as indicated on the plans
 5. Length: As specified on the Plans
 6. Pipe connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section
- B. Frames and Grates:
 1. General: All structures identified as Drain Inlets (DI) or Outfall Structures on the Plans shall have open grates. All structures identified as a Junction Box (JB) shall have a solid lid. Refer to the Storm Drain Structure Schedule on the Plans.
 2. All grates and covers must be match-marked so they fit snugly in the frame and do not rock upon completion.
 3. All grates and covers within the path of travel must be ADA compliant.
 4. All grates and covers within vehicle-traffic areas must be designed for H20 loading.
 5. Drop inlet structures located within new paving shall have an adjustable steel paving notch frame that allows for pavement to be installed up to the frame.
 6. Covers/Grates to have Nickel Bronze Finish.
 7. Manufacturers:
 - a. Neenah Foundry.
 - b. Urban Accessories.
 - c. Or equal.
- C. ADA-compliant grates
 1. All grates in pedestrian pavement and in vehicular areas with foot traffic must be ADA complaint.
- D. Beehive/Atrium Grates:
 1. Beehive/Atrium Grates to be used on all overflow and bubbler structures within the Rain Garden and within landscaped areas where noted on the Plans.
 2. Description: Convex grate to be used with square precast concrete inlet structure on overflow inlet within rain garden or at bottom of landscape swale. See Plans for location.
 3. Size: 12-inch diameter across top of grate.
 4. Grate: Cast iron.
 5. Manufacturers:
 - a. Neenah Foundry
 - b. Model: R-2560-A

2.9 DRAIN BASINS AND GRATES

- A. PE Atrium Drop-In Grates (within landscape areas only):
 1. 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:
 - a. NDS
 - b. Hancor Technology Innovation Solutions
 - c. Or equal.

2. Description: Plastic round body with atrium drop-in grate made to fit round basins, corrugated single wall pipe or PVC pipe. (To be used in landscape areas only)
 3. Color: Black
 4. Sizes and locations per the Plans.
- B. Square Drop-In Grates (within paved areas only);
1. 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:
 - a. NDS
 - b. Hancor Technology Innovation Solutions
 - c. Or equal.
 2. Description: Square drop-in grate made to fit round basins, corrugated single wall pipe or PVC pipe.
 3. Material/Color/finish: Nickel bronze (preferred) or satin brass.
 4. Sizes and locations per the Plans.
- C. ADA-compliant grates
1. All grates in pedestrian pavement and in vehicular areas with foot traffic must be ADA complaint.
- D. PE Basins:
1. 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:
 - a. NDS
 - b. Hancor Technology Innovation Solutions
 - c. Or equal.
 2. Description: Plastic round body made to fit round grates by same manufacturer, and corrugated single wall pipe, single wall HDPE fittings, and PVC pipe.
 - a. Color: Black
 - b. Locations and sizes per the Plans.

2.10 POLYMER CONCRETE CHANNEL DRAINAGE SYSTEMS

- A. General Requirements for Polymer-Concrete, Channel Drainage Systems: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include quantity of units required to form total lengths indicated.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide ACO USA Klassik Drain, K100S.
- C. Sloped-Invert, Polymer-Concrete Systems:
1. Channel Sections:
 2. Interlocking-joint, precast, modular units with end caps.
 3. 4-inch inside width and deep, rounded bottom, with invert sloped at 0.6% and with outlets in quantities, sizes, and locations indicated.
 4. Extension sections necessary for required depth.
 5. Frame: Include galvanized steel frame for grate.
 6. Grate on pedestrian path connecting Alumni Plaza to Garage:
 7. Manufacturer's designation "Medium Duty," with slots or perforations that fit recesses in channels.
 8. Rated for pedestrian at minimum

9. Material/Color/Finish: Nickel bronze (preferred) or satin brass
10. Pattern: ACO'S Perforated Brass or equal approved by Landscape Architect
11. Slot openings shall not be greater than 0.5 inch in direction of travel to meet accessibility code requirements
12. Grate shall be heel-safe and bicycle-safe
13. Quicklok grate locking mechanism

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 31 22 00 – Earthwork and Grading and Section 31 23 33 – Trenching, Backfilling and Compacting.

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- D. Install gravity-flow, nonpressure drainage piping according to the following:
 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
 2. Install main line piping with 24-inch minimum cover.
 3. Install PE corrugated sewer piping according to CPPA's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."

3.3 PIPE JOINT CONSTRUCTION

- A. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.
- B. Join gravity-flow, nonpressure drainage piping according to the following:
 1. PE piping according to CPPA 100
- C. Use silttight couplings for Type 2, silttight joints.
 1. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast iron soil pipe fittings in sewer pipes at branches for cleanouts and cast iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
 2. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
- B. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.5 MAINTENANCE HOLES

- A. Install maintenance hole, complete with appurtenances and accessories indicated.
- B. Install precast concrete maintenance hole sections with sealants according to ASTM C 891.
- C. Where specific maintenance hole construction is not indicated, follow maintenance hole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of maintenance holes that occur in pavements unless otherwise indicated in Drawings. Set tops 3-inch (76-mm) above finished surface elsewhere unless otherwise indicated in Drawings.

3.6 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
1. Use Medium-duty, top-loading classification drains in paved foot-traffic areas and landscape areas.
 2. Use Heavy-duty, top-loading classification drains in vehicle-traffic service areas.
 3. Use heel-proof/ADA compliant grates in all paved areas.
- B. Fasten grates to drains as recommended by the manufacturer for landscape area drains.
- C. For landscape planters, set atrium drains 2 inches above surrounding finish ground elevation.
- D. Rain Garden Overflow Drain Installation:
1. Rim or top of grate elevation specified on Plans represents elevation at bottom of convex portion of grate component, not the bottom of frame or top of concrete inlet. Contractor shall mound soil around inlet enough to cover concrete structure and frame by 2-inches. River rock shall be placed around all rain garden overflow and bubbler drains to form an 18-inch minimum wide rock collar to prevent erosion at the base of the structure. Contractor to coordinate with the Landscape Architect on rock type.
- E. Trench Drain Installation:
1. Install sloped invert and neutral sections per detail provided on the Plans.
 2. Core drill and connect outlet pipe per detail on the Plans and as recommended by the manufacturer.
 3. Set grades to be flush with finish surface of adjacent paving.
 4. Refer to the manufacturer's installation guidelines for additional direction.

3.7 CONNECTIONS

- A. Make connections to existing piping and underground structures.
1. Make branch connections from side into existing structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be

- packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, maintenance hole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
2. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
 3. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 4. Protect existing piping, maintenance holes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 2. Unshielded flexible couplings for same or minor difference OD pipes.
 3. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 4. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.8 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use procedure below:
1. Pipes with diameters less than 12 inches: Close open ends of piping with threaded metal caps, plastic plugs, concrete slurry, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
 2. Pipes with diameters 12 inches or greater: Close open ends of piping with suitable plug and fill abandoned pipe with flowable fill.
- B. Backfill to grade according to Section 31 22 00 – Earthwork and Grading and Section 31 23 33 – Trenching, Backfilling and Compacting.

3.9 INFILTRATION TRENCH SYSTEM INSTALLATION

- A. Refer to manufacturer requirements for delivery, storage and installation recommendations.

3.10 IDENTIFICATION

- A. Materials and their installation are specified in Section 31 22 00 - Earthwork and Grading and Section 31 23 33 Trenching, Backfilling and Compacting. Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.11 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - 3. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - 4. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - 5. Crushed, broken, cracked, or otherwise damaged piping.
 - 6. Infiltration: Water leakage into piping.
 - 7. Exfiltration: Water leakage from or around piping.
 - 8. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
 - 9. Re-inspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.
 - 5. Gravity-Flow Storm Drainage Piping: Test plastic piping according to requirements of authorities having jurisdiction, UNI-B-6, and ASTM F 1417.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.12 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION

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SECTION 33 47 27 - BIORETENTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes:
 - 1. Bioretention Soil Mix
 - 2. Aggregate Storage Materials
 - 3. Mulch
 - 4. Dissipation cobbles
- B. Related Sections:
 - 1. Section 01 56 39 – Temporary Tree and Plant Protection
 - 2. Section 32 01 90 – Landscape Maintenance
 - 3. Section 32 84 00 – Irrigation
 - 4. Section 32 91 13 – Soil Preparation
 - 5. Section 32 92 00 – Turf and Grasses
 - 6. Section 32 93 00 – Plants

1.03 STANDARDS AND CODES

- A. Reference Standards: This section incorporates by reference the latest versions of the following documents. These references are a part of this section as specified and modified.
 - 1. Caltrans: Standard specifications
 - 2. ASTM: Annual Book of ASTM Standards, American Society for Testing and Materials, latest edition.

1.04 DEFINITIONS

- A. Bioretention Soil Mix (BSM): A soil mix that has been specially blended and tested for use in bioretention facilities with the intent to meet the following objectives:
 - 1. Infiltrate runoff at a minimum rate of 5 inches per hour throughout the life of the facility, and
 - 2. By nature of its components be capable of the removal of certain suspended and dissolved stormwater pollutants, and
 - 3. Have sufficient moisture retention and other agronomic properties to support healthy vegetation.

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- B. AASHTO: American Association of State Highway and Transportation Officials.
- C. CAP: Compost Analysis Proficiency
- D. STA: Seal of Testing Assurance
- E. TMECC: Test Method for the Examination of Composting and Compost
- F. USCC: US Composting Council

1.05 REFERENCES

- A. Geotechnical Report prepared by Terraphase Engineerig and dated July 2020.
- B. CalTrans: Standard specifications
- C. ASTM D2434: Standard test method for permeability of granular soils
- D. ASTM D1557: Standard test methods for laboratory compaction characteristics of soil
- E. ASTM D6938: Standard test methods for in-place density and water content of soil and soil aggregates
- F. ASTM D2216: Standard test methods for laboratory determination of water content of soil and rock

1.06 SUBMITTALS

- A. Pre-Installation Submittals: Submit to the Landscape Architect the following a minimum of 20 calendar days prior to the construction of bioretention facilities:
 - 1. Bioretention Soil Mix Submittals
 - a. Sample: One pint sample of the BSM, in clear Ziploc bag, with labels indicating material, source, and date obtained.
 - b. Soil testing laboratory results and recommendations for organic amendments. Refer to section 32 91 13 "Soil Preparation" for testing requirements.
 - c. Source certificates for all BSM materials.
 - d. Sieve analysis of BSM per ASTM D422 performed within two (2) months of product delivery to site
 - e. Certification from the soil supplier or an accredited testing agency that the BSM, including sand and compost components, conforms to all industry or technical society reference standards specified in Sections 2.01.A, 2.01.B, and 2.01C.
 - f. A description of the equipment and methods used to mix the sand and compost to produce BSM.
 - g. Organic content test results of the BSM, performed in accordance with Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, "Loss-On-Ignition Organic Matter Method."
 - h. Permeability test results for BSM per ASTM D2434 (Modified).
 - 2. Sand Submittals

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- a. Sieve analysis of sand per ASTM D422 performed within two (2) months of product delivery to site.
3. Compost Submittals
 - a. Quality analysis results for compost performed in accordance with STA standards, and performed within two (2) months of product delivery to site.
 - b. Sieve analysis of compost per TMECC 02.02-B performed within two (2) months of product delivery to site.
4. Other Submittals
 - a. Cut sheets of any media or soil admixes to enhance moisture retention properties.
 - b. Testing agency qualifications as specified.

1.07 QUALITY CONTROL AND QUALITY ASSURANCE

- A. General: Test and inspect bioretention materials and operations as Work progresses as described in this section. Failure to detect defective Work or materials at any time will not prevent rejection if a defect is discovered after installation, nor shall it constitute final acceptance.
- B. Testing Agency Qualification:
 1. General: Agencies that perform testing on bioretention materials, including permeability testing, shall be accredited by STA, ASTM, AASHTO, or other designated recognized standards organization. All certifications shall be current. Testing agency shall be capable of performing all tests to the designated and recognized standards specified and shall provide test results with an accompanying Manufacturer's Certificate of Compliance. The following information shall be provided for all testing laboratories used:
 - a. Name of lab(s) and contact person(s)
 - b. Address(es) and phone number(s)
 - c. Email address(es)
 - d. Qualifications of laboratory and personnel including the date of current certification by STA, ASTM, AASHTO, or approved equal.
 2. Compost: Laboratory that performs testing shall be independent, enrolled in the US Composting Council's (USCC) Compost Analysis Proficiency (CAP) program, and perform testing in accordance with USCC Test Method for The Examination of Composting and Compost (TMECC). The sample collection protocol can be obtained from the U.S. Composting Council, 4250 Veterans Memorial Highway, Suite 275, Holbrook, NY 11741, 631-737-4931, www.compostingcouncil.org.
- C. Responsibilities of Contractor
 1. Submittals: Some of the tests required for this specification are unique, and BSM shall be considered a long-lead-time item. Under no circumstance shall failure to comply with all specification requirements be an excuse for a delay or for expedient substitution of unacceptable material(s).
 2. Testing: All testing specified herein is the responsibility of the Contractor and shall be conducted by an independent testing agency, retained by the Contractor. The Owner

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reserves the right to conduct additional testing on all materials submitted, delivered, or in-place to ensure compliance with Specifications.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect the BSM and mulch from contamination and all sources of additional moisture at supplier site, during transport, and at the project site, until incorporated into the Work.
- B. The Contractor is required to coordinate delivery of BSM and aggregates with bioretention facility excavation and soil installation. A written schedule shall be submitted for review as part of the submittal package. BSM should not be stockpiled onsite for any length of time. In no case shall BSM be stockpiled onsite for more than 24 hours without prior written approval by the Engineer/Landscape Architect. If stockpiling onsite for longer than 24 hours, BSM stockpiles shall meet the following requirements:
 - 1. Locate stockpiles away from drainage courses, inlets, sewer cleanout vents, and concentrated stormwater flows
 - 2. Place stockpiles on geotextile fabric
 - 3. Cover stockpiles with plastic or comparable material
 - 4. Contain stockpiles (and prevent contamination from adjacent stockpiles) with temporary perimeter barrier (e.g., sand bags, wattles, silt fence)

PART 2 PRODUCTS

2.01 BIORETENTION SOIL MIX (BSM)

- A. General: BSM shall be a well-blended mixture of sand and compost, shall have sufficient moisture retention to support healthy plant growth, and shall meet the following criteria:
 - 1. Mixture proportions: 30 to 40 percent Compost by volume and 60 to 70 percent Sand by volume.
 - 2. Organic matter content: 4 to 8 percent as determined by TMECC 05.07-A, Loss on Ignition Method.
 - 3. Extraneous materials: BSM shall be free of all roots, plants, weeds, sod, stones, clods, pockets of coarse sand, construction debris, or other extraneous materials harmful to plant growth.
 - 4. Permeability/Saturated Hydraulic Conductivity: 10 inches per hour minimum, tested in accordance with ASTM D2434 (Modified). See Modified ASTM D2434 Procedures for required modifications to test.
 - 5. Acceptance of BSM quality and performance may be based on samples taken from stockpiles at supplier's yard, submitted test results, and/or onsite and laboratory testing of installed material at the discretion of the Engineer/Landscape Architect. The point of acceptance will be determined in the field by the Engineer/Landscape Architect.

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B. Sand: Sand in the BSM shall conform to the requirements for Sand, Type B specified herein, unless otherwise approved by the Engineer/Landscape Architect.

1. Sand shall be free of wood, waste, coating, or any other deleterious material.
2. Sand material shall meet the following specifications for gradation.

Sieve Size ¹	Percent Passing by Weight	
	Type A ²	Type B (low fines) ³
3/8 inch	100	100
No. 4	90 to 100	90 to 100
No. 8	70 to 100	70 to 100
No. 16	40 to 95	40 to 85
No. 30	15 to 70	15 to 60
No. 50	5 to 55	8 to 15
No. 100	0 to 15	0 to 4
No. 200	0 to 5	0 to 2

¹ Sieve provided in nominal size square openings or United States Standard Sieve Series sizes.

² Sand conforming to ASTM C33 for Fine Aggregate satisfies the requirements of this specification for Sand, Type A.

³ Type B (low fines) sand gradation pending local availability.

3. Coefficient of Uniformity: $C_u = \frac{D_{60}}{D_{10}}$: 4 or less for Sand, Type B.
4. Effective Particle Size (D10): 0.3 to 0.5 mm for Sand, Type B.
5. All aggregate passing the No. 200 sieve shall be non-plastic.
6. Acceptance of grading and quality of the sand may be based on samples taken from stockpiles at supplier's yard or a submitted gradation report at the discretion of the Engineer/Landscape Architect. The point of acceptance will be determined in the field by the Engineer/Landscape Architect.
7. Compost: Compost in the BSM shall be well decomposed, stable, weed free organic matter sourced from waste materials including yard debris, wood wastes or other organic materials, not including biosolids or manure feedstock. Compost shall conform to California Code of Regulations Title 14, Division 7, Chapter 3.1 requirements, be certified through the USCC Seal of Testing Assurance (STA) Program, and meeting the criteria specified herein.
8. Feedstock: Feedstock materials shall be specified and include one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues. Feedstock shall not include biosolids or manure.
9. Organic Matter Content: 35 to 75 percent by dry weight tested in accordance with TMECC 05.07-A (Loss on Ignition Organic Matter Method).

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10. Carbon to Nitrogen Ratio: C:N between 15:1 and 25:1 when tested in accordance with TMECC 05.02-A.
11. Maturity/Stability: shall have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120°F) upon delivery or rewetting is not acceptable. In addition any one of the following is required to indicate stability:
 - a. Specific Oxygen Uptake Rate (SOUR): 1.5 milligrams O₂ per gram biodegradable volatile solids per hour (maximum) per TMECC 05.08-A.
 - b. Carbon Dioxide Evolution Rate: 8 milligrams CO₂ per gram volatile solids per day per TMECC 05.08-B.
 - c. Dewar Self Heating Test: 20°C temperature rise (maximum) per TMECC 05.08-D (Class IV or V).
 - d. Solvita®: Index value greater than 6 per TMECC 05.08-E.
12. Toxicity: Seed Germination: greater than 80 percent of control AND Vigor: greater than 80 percent of control per TMECC 05.05-A.
13. Nutrient Content: provide analysis detailing nutrient content including N-P-K, Ca, Na, Mg, S, and B.
 - a. Total Nitrogen: 0.9 percent minimum.
 - b. Boron: Total shall be < 80 ppm
14. Salinity/Electrical Conductivity: less than 6.0 deciSiemen per meter (dS/m or mmhos/cm) per TMECC 04.10-A (1:5 Slurry Method, Mass Basis).
15. pH: 6.5 to 8 per TMECC 04.11-A (1:5 Slurry pH).
16. Gradation: Compost for BSM shall meet the following size gradation per TMECC 02.02-B; test shall be run on dry compost sample:

Sieve Size	Percent Passing by Weight	
	<i>Min</i>	<i>Max</i>
1 inch	99	100
1/2 inch	90	100
1/4 inch	40	90
No. 200	1	10

17. Bulk density: 500 to 1,100 dry pounds per cubic yard.
18. Moisture content: 30 to 55 percent of dry solids.
19. Inerts: compost shall be relatively free of inert ingredients, including glass, plastic and paper, less than 1 percent by weight or volume per TMECC 03.08A.
20. Weed seed/pathogen destruction: provide proof of process to further reduce pathogens (PFRP). For example, turned windrows must reach minimum 55°C for 15 days with at least 5 turnings during that period.
21. Select Pathogens
 - a. Salmonella: less than 3 Most Probable Number per 4 grams of total solids, dry weight per TMECC 07.02.

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- b. Coliform Bacteria: fecal coliform less than 1,000 Most Probable Number per gram of total solids, dry weight per TMECC 07.01.
22. Trace Contaminants Metals (lead, mercury, etc.): Product must meet US EPA, 40 CFR 503 regulations.

2.02 AGGREGATE STORAGE

- A. Aggregate Storage shall consist of hard, durable, and clean, sand, gravel, or mechanically crushed stone, substantially free from adherent coatings. Materials shall be washed thoroughly to remove fines, organic matter, extraneous debris, or objectionable materials. Recycled materials are not permitted. The material shall be obtained only from a source(s) approved by the Engineer/Landscape Architect. Written requests for source approval shall be submitted to the Engineer/Landscape Architect not less than ten (10) working days prior to the intended use of the Material. Should the proposed source be one that the Engineer/Landscape Architect has no history of Material performance with, the Engineer/Landscape Architect reserves the right to take preliminary samples at the proposed source, and make preliminary tests, to first determine acceptability of the new source and then perform the applicable Material approval testing. Continued approval of a source is contingent upon the Materials from that source continuing to meet Contract requirements. Materials shall meet CalTrans Standard Specifications for grading and quality for use in the Work; however, allowable exceptions may be specified in the Contract.
- B. Aggregate storage shall meet the following specifications for grading and quality.
- Aggregate gradation testing in accordance with ASTM C136 at least once per 500 cubic yards.

Sieve ¹	Percent Passing by Weight		
	Choking Course ASTM No. 9 (Modified) ³	Reservoir Course ASTM No. 7 (Modified) ⁴	Caltrans Class 2 Permeable Aggregate (MS4 Areas Only)
1 inch	—	—	100
3/4 inch	—	100	90 to 100
1/2 inch	100	90 to 100	—
3/8 inch	100	40 to 70	40 to 100
No. 4	85 to 100	0 to 15	25 to 40
No. 8	10 to 40	0 to 5	18 to 33
No. 16	0 to 10	—	—
No. 30	—	—	5 to 15
No. 50	—	—	0 to 7
No. 200 ²	0 to 2	0 to 2	0 to 3

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- ¹ Sieve provided in nominal size square openings or United States Standard Sieve Series sizes.
 - ² Gradation modified from ASTM for portion passing the No. 200 sieve.
 - ³ Materials likely to meet this specification are available locally as Graniterock 1/4" premium screenings (Wilson 1/4" x #10 Premium Screenings).
 - ⁴ Materials likely to meet this specification are available locally as Graniterock 1/2" premium screenings (Wilson 1/2" x #4 Roofing Aggregate).
2. Crushed Particles: 90 percent minimum fractured faces tested in accordance with California Test 205. Do not use rounded river gravel.
 3. L.A. Abrasion: 40 percent maximum tested in accordance with ASTM C 131.

2.03 MULCH

- A. Mineral mulch. Refer to Section 32 93 00 "Plants" and to Drawings for type of Cobbles.

2.04 STREAMBED GRAVEL

- A. Refer to Civil Drawings and Specifications.

PART 3 EXECUTION

3.01 GENERAL

- A. Prevent runoff from adjacent pervious and impervious surfaces from entering the bioretention facility (e.g., sand bag inlet curb cuts, stabilize adjacent areas, flow diversion) until authorization is given by the Engineer/Landscape Architect.
- B. Exclude equipment from bioretention facilities. No equipment shall operate within the facility once bioretention facility excavation has begun, including during and after excavation, backfilling, mulching, or planting.
- C. Prevent foreign materials and substances, such as silt laden run-off, construction debris, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid from entering or being stored in the facility at any point during construction.

3.02 GRADING

- A. The Contractor shall not start bioretention facility grading until all areas draining to the facility are stabilized and authorization has been given by the Engineer/Landscape Architect.
- B. Construct bioretention facility subgrade to +/- 3/4 inch of the grades and slopes specified on the Plans.

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- C. Excavation within 6 inches of final native soil grade shall not be permitted if facility soils have standing water, or have been subjected to more than 1/2 inch of precipitation within the previous 48 hours.

3.03 SUBGRADE PREPARATION AND PROTECTION

- A. Protect the bioretention excavation from over compaction and/or contamination.
 - 1. Areas which have been over-compacted by equipment or vehicle traffic or by other means and which need to be ripped, over excavated, receive additional scarification, or other restorative means shall be done at the Contractor's expense and at the direction of the Engineer/Landscape Architect.
 - 2. Excavated areas contaminated by sediment laden runoff prior to placement of BSM or Aggregate Storage material shall be remediated at the Contractor's expense by removing the contaminated soil (top 3 inches minimum) and replacing with a suitable material, as determined by the Engineer/Landscape Architect.
- B. Remove all trash, debris, construction waste, cement dust and/or slurry, or any other materials that may impede infiltration into prepared subgrade.
- C. The subgrade shall be inspected and accepted by the Engineer/Landscape Architect prior to placement of any materials or final subgrade scarification.
- D. Scarify the surface of the subgrade to a minimum depth of 3 inches immediately prior to placement of BSM or aggregate storage material. Acceptable methods of scarification include use of excavator bucket teeth or a rototiller to loosen the surface of the subgrade.
- E. Place aggregate storage material, where shown on drawings with conveyor belt or with an excavator or loader from a height no higher than 6 feet unless otherwise approved by the Engineer/Landscape Architect. Do not dump material directly from truck into cell.
- F. Aggregate Storage areas contaminated by sediment-laden runoff prior to placement of BSM shall be remediated at the Contractor's expense by removing the contaminated aggregate storage material (top 3 inches minimum or as directed by the Engineer/Landscape Architect) and replacing with clean aggregate storage material to the lines and grades on the Plans.
- G. Aggregate Storage material shall be inspected and accepted for placement and finish grade by the Engineer/Landscape Architect prior to the installation of BSM. Any material that does not conform to this Specification shall be removed and replaced with acceptable material or remediated to the satisfaction of the Engineer/Landscape Architect, at the Contractor's expense.

3.04 BIORETENTION SOIL MIX PLACEMENT

- A. The Contractor shall not place BSM until the Engineer/Landscape Architect has reviewed and confirmed the following:
 - 1. BSM delivery ticket(s): Delivery tickets shall show that the full delivered amount of BSM matches the product type, volume and manufacturer named in the submittals. Each delivered

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batch of BSM shall be accompanied by a certification letter from the supplier verifying that the material meets specifications and is supplied from the approved BSM stockpile.

2. Visual match with submitted samples: Delivered product will be compared to the submitted 1-gallon sample, to verify that it matches the submitted sample. The Engineer/Landscape Architect may inspect any loads of BSM on delivery and stop placement if the soil does not appear to match the submittals; and require sampling and testing of the delivered soil to determine if the soil meets the requirements of this Section before authorizing soil placement.
 3. Inspection of the aggregate storage layer, underdrain, cleanout, and overflow structure installation, where included on the plans.
- B. BSM placement, grading and consolidation shall not occur when the BSM is excessively wet, or has been subjected to more than 1/2 inch of precipitation within 48 hours prior to placement. Excessively wet is defined as being at or above 22 percent soil moisture by a General Tools & Instruments DSMM500 Precision Digital Soil Moisture Meter with Probe, or equivalent. A minimum of three readings with the soil moisture probe will be used to determine the average percent soil moisture reading per each truck load. There should be no visible standing water in the material.
 - C. The Contractor shall place BSM loosely with a conveyor belt or with an excavator or loader from a height no higher than 6 feet, unless otherwise approved by the Engineer/Landscape Architect; do not dump material directly from truck into cell. Soil shall be placed upon a prepared subgrade in accordance with these Specifications and in conformity with the lines, grades, depth, and typical cross-section shown in the Drawings or as established by the Engineer/Landscape Architect.
 - D. Excessively dry BSM may be lightly and uniformly moistened, as necessary, to facilitate placement and workability.
 - E. Compact BSM using non-mechanical compaction methods (e.g., boot packing, hand tamping, or water consolidation) to 81 percent to 85 percent of the maximum dry density per modified Proctor test (ASTM D1557), or as directed by the Geotechnical Engineer. Determination of in-place density shall be made using a nuclear gauge per ASTM D6938. Moisture content determination shall be conducted on a soil sample taken at the location of the nuclear gage reading per ASTM D2216.
 - F. Grade BSM to a smooth, uniform surface plane with loose, uniformly fine texture. Rake, remove ridges, and fill depressions to meet finish grades.
 - G. Final soil depth shall be measured and verified only after the soil has been compacted. If after consolidation, the soil is not within +/- 3/4 inch of the grades and slopes specified on the Plans, add material to bring it up to final grade and raked.
 - H. The BSM shall be inspected and accepted for placement and finish grade by the Engineer/Landscape Architect prior to the installation of planting and mulch. Any BSM that does not conform to this Specification shall be remediated to the satisfaction of the Engineer/Landscape Architect, or removed and replaced with acceptable BSM, at the Contractor's expense.

3.05 PLANTING AND MULCHING

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- A. Bioretention facilities shall be planted and mulched as shown on the Drawings.
 - 1. Bioretention facilities shall not be planted or mulched when soils are excessively wet.
- B. Bioretention facility areas contaminated by sediment laden runoff prior to planting or placement of mulch shall be remediated at the Contractor's expense by removing the contaminated BSM (top 3 inches minimum) and replacing with BSM to the lines and grades on the Drawings.
- C. All mulch shall be inspected and accepted by the Engineer/Landscape Architect to ensure appropriate depth and material prior to facility commissioning (e.g., unblocking of inlets).

3.06 FLOOD TESTING

- A. Inlets shall be constructed per the Drawings and free from all obstructions prior to commencing flow testing.
- B. Testing shall be conducted at the conclusion of the 90-day plant grow-in period. Protection and flow diversion measures installed shall be removed in entirety prior to commencing flow testing.
- C. Underdrains shall be plugged at the outlet structure to minimize water consumption during testing.
- D. Prior to testing, broom sweep gutter and other impervious surfaces within the test area to remove sediments and other objectionable materials.
- E. The Engineer/Landscape Architect shall be present during the demonstration. The Contractor shall notify the Engineer/Landscape Architect a minimum of 2 working days prior to testing.
- F. The Contractor shall water test each facility to demonstrate that all inlet curb openings are capturing and diverting all water in the gutter to the facility, outlet structures are engaging at the elevation specified, and the designed ponding depth is achieved. Testing shall include application of water from a hydrant or water truck at a minimum rate of 10 gallons per minute, into the gutter a minimum of 15 feet upstream of the inlet curb opening being tested. Each inlet shall be tested individually. If erosion occurs during testing, restore soils, plants, and other affected materials.
- G. Engineer/Landscape Architect will identify deficiencies and required corrections, including but not limited to relocating misplaced plants, adjusting streambed gravel, adjusting mulch or dissipation cobbles, adjusting inlets, splash aprons, and forebays, removing and replacing inlets, and removing debris.
- H. Once adjustments are made, the Contractor shall re-test to confirm all test water flows into the facility from the gutter and correct any remaining deficiencies identified by Engineer/Landscape Architect.
- I. Inlets, outlets, and other bioretention facility appurtenances shall not be accepted until testing and any required correction and retesting is complete and accepted by the Engineer/Landscape Architect.

END OF SECTION

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